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FIFTH

ANNUAL REPORT

OF THE

Commissioner of Agriculture

FOR

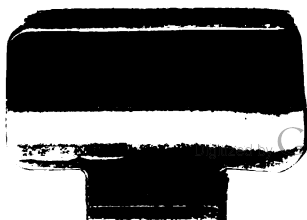
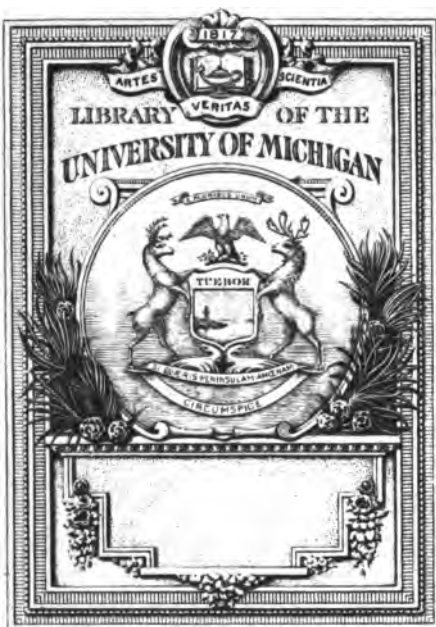
VIRGINIA,

ILLUSTRATED WITH A PHOTOGRAPH

"SHEEP HUSBANDRY FOR VIRGINIA."

RICHMOND:

H. F. WALKER, SUPERINTENDENT OF PUBLIC PRINTING,
1881.



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FIFTH

ANNUAL REPORT

OF THE

Commissioner of Agriculture

OF

VIRGINIA,

ACCOMPANIED WITH A TREATISE ON

"SHEEP HUSBANDRY FOR VIRGINIA."

RICHMOND:
R. F. WALKER, SUPERINTENDENT OF PUBLIC PRINTING.
1881.

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COMMONWEALTH OF VIRGINIA,
DEPARTMENT OF AGRICULTURE,
RICHMOND, December , 1881.

To His Excellency F. W. M. HOLLIDAY,
Governor of Virginia :

SIR :

I have the honor to present to you, and through you the Legislature of Virginia, this my Fifth Annual Report, accompanied with a treatise on "Sheep Husbandry for Virginia.

Very respectfully,

Your obedient servant,

TH. POLLARD,
Commissioner of Agriculture.

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JOHNS & GOOLSBY, PRINTERS.

INTRODUCTORY.

Believing I could do good service for the farmers of Virginia, and at the suggestion of some of our sheep raisers, I determined to prepare the treatise on "Sheep Husbandry," which was designed to be of a practical character, to accompany my "Fifth Annual Report." The inducements to bind them together were economy; and the fact that the treatise in question has consumed so much of my time that my report is necessarily shorter than usual.

The appropriation at my disposal is so small, and out of this appropriation all my printing has to be done, that I find it necessary to economize my small fund in every way practicable. By binding together the Report and the treatise on "Sheep Husbandry," I find that there will be considerable saving, and probably some also in their distribution through the mails.

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REPORT.

The Department of Agriculture remains organized as at the time of my last Report, with Capt. M. K. Crenshaw as clerk, and Prof. W. H. Taylor, State Chemist, as chemist to this Department—to each of whom I desire to proffer my thanks for their faithful performance of their respective duties. In this connection, I cannot forbear from again calling the attention of the Legislature to the inadequate and unequal salary (\$600 per annum) received by my clerk—less than that of any other clerk in any other Department of the Government, and not half that of the chief clerks of these Departments; and, indeed (and I feel almost ashamed to say it), less than the pay of the porter in the basement of the Capitol. Is there any justice or equality in this? or is agriculture so unimportant or of less dignity than other departments of the Government that the clerk of the Department of Agriculture has to labor the same number of hours, and with the same assiduity as the other clerks, on half their pay?

With a full appreciation of the financial troubles of our State Government, I feel it is justifiable and proper that I should direct attention of the incoming Legislature to the inadequacy of the appropriation to sustain this Department and carry it on to better advantage. I do not deem it indelicate to say that the Department is well established in popular favour, judging from the number of communications received from farmers commending its administration and usefulness, but almost universally regretting the inadequacy of the appropriation to sustain it; and we believe if to-day the voice of the farmers could be authoritatively heard, a large majority would be found in favour of a more liberal appropriation to support and extend the usefulness of *their* Department. From their hard-earned income, derived from constant toll, the Government derives its support, and surely an institution organized for their special benefit should have the means to make itself thoroughly useful, and prepared to meet their wants in every way they might have cause to demand its assistance. The sum appropriated annually to this Department is \$2,900 (exclusive of salaries to the amount of \$2,100). From this \$2,900 all the printing of the Department, analysis of fertilizers and minerals, and collection of minerals of the State must come; and then a geological survey of each county of the State is required, which last is utterly impracticable, as it would cost more than twelve times my appropriation. If all the fertilizers sold in the State were analyzed, it would take nearly the whole amount of appropriation. The consequence is, I have to make a selection of those deemed

most important, leaving unanalyzed nearly one-half. The printing for my Department costs annually \$1,000, and yet I cannot print for the farmer more than 5,000 of my Annual Reports, while, assuming that they have any value, I should print twenty or thirty or more thousands of; for it must be remembered that we have probably a hundred and fifty thousand farmers, many of whom are reading men. Then again, as regards collections of specimens of our minerals, this is an important matter, and requires money. The mineral interests of Virginia are assuming large proportions, and our mineral deposits promise to be great sources of revenue to the State. It is true that the mineral specimens thus far collected have cost the State nothing, but the cases and rent of room, with occasionally some freight, though the Railroads have been liberal enough to grant free transportation for minerals, and I desire, in behalf of the State, to return them my grateful thanks, as well as for a free pass when I am travelling on business appertaining to the duties of the Department. Had I the means, I would send out in the summer months an intelligent agent, and have made a full collection of all the minerals of the different counties of the State. This is a matter of great importance to our interests, as with the mineral specimens of the different parts of the State spread before him, any one seeking investment in minerals and mineral lands could obtain most of the desired information sought, instead of making extended trips over the State for the purpose, and then be liable to fall in his object. I should have the means of having analyzed all the minerals parties might send me for the purpose. As it is, I can only have analyzed a very moderate number I may deem of most importance. I have to say to parties that if there is a good probability of the minerals being valuable by being mined, and a source of revenue to the community and the State, that then I will have the analysis made at the expense of the Department, but that if the mineral did not promise these things, being seemingly of little value and entirely for private gratification and information, that then the party must pay for it.

Other States have supported their Agricultural Departments by imposing a tax on fertilizers sold in the State. Georgia does this by a system of inspections of fertilizers, charging fifty cents on each ton of fertilizers inspected in the State, when introduced or manufactured for sale. This yields a revenue of \$50,000, as at least 100,000 tons of fertilizers are annually sold in the State—a much larger amount than is used in Virginia. This amount is considerably more than enough to support the Department of Agriculture on quite a liberal scale. North Carolina imposes a tax of \$500 on each brand of fertilizer sold in the State. We are not certain of the amount produced by this tax, but it is over \$20,000. South Carolina imposes a tax of 25 cents on each ton of fertilizer introduced or manufactured in the State.

Of these laws, we think those of Georgia and South Carolina are most just, as they are somewhat “ad valorem,” and the burden is not so sensibly felt. The tax of North Carolina may operate harshly, and no doubt does so in some cases of beginners in the business, who have to pay the tax before they have sold any of their manufacture, and whose profits may never amount to \$500 per annum. This deters manufacturers of small means and beginners from taking out this license to sell, and tends to throw the trade into the hands of large dealers and capitalists, and may thus prevent healthy competition. Such hardship cannot attend the execution of the Georgia or South Carolina laws, the action of which is not much felt or complained of. The constitutionality of these laws taxing the sale of fertili-

zers has been denied by some. I am not lawyer enough to pronounce on this, but analogy and custom sustain it. The State taxes pretty much everything it pleases. Inspectors of flour and tobacco are paid by the manufacturers and producers of these articles. If a farmer buys or raises a horse or cow, the animal has a yearly tax imposed on it as long it lives. Every clock, or watch, and all furniture introduced or manufactured in the State, and purchased by an individual, has a yearly tax imposed on it; and this in addition to a yearly tax paid by the persons who sell these articles. It has been urged as an argument against the policy of these laws that the tax at last comes out of the farmer who buys fertilizers. We have no idea that this is true in regard to the action of the Georgia or South Carolina laws, or, at most, can be only partially true. It is scarcely probable that a manufacturer who was selling his brand at \$40 per ton would, in consequence of this tax raise it to \$40.50 for Georgia, and \$40.25 for South Carolina. This would probably produce more discontent and diminished sales among farmers than would be compensated for by the increase of price in the fertilizer. In most cases of tax or tariff imposed upon articles, the burden is borne partly by the producer and partly by the consumer. If the seller adds the whole tax imposed, as some say, then his sales will be diminished, and losses be thus incurred. In many cases, no doubt, the merchant or seller is forced to add a portion of the tax to the price of the article to save himself from loss, but the profit made on the sale of fertilizers is good, and we doubt whether any of the tax is added to the price of the fertilizer in the cases referred to; for instead of advance of prices of these articles, there has been generally a reduction since the enactment of these laws—not as a consequence of the action of the law, but in spite of the supposed effect in adding to the price.

There has been little or no complaint among fertilizer manufacturers about the tax imposed upon them in Georgia and South Carolina, while there has been heavy complaint in regard to the North Carolina laws, and a threatening to test its constitutionality in the courts.* It is said, very justly, that if a manufacturer sells a ton of fertilizer he is supposed to make a profit, and almost universally does so, while under the North Carolina law he may not clear enough to pay the tax, operating harshly, as said, upon beginners, who have the tax to pay before they have sold anything, besides driving off manufacturers of small means without an attempt at competition with men of capital. The Georgia, or even the South Carolina law, if enacted in Virginia, would turn into the treasury, we suppose, an amount sufficient to meet the expenses of this Department on a much enlarged scale. I have no means of estimating the amount of commercial fertilizers sold in the State, but conjecture it is something near 40,000 tons. Two years ago I attempted to get from the Railroad authorities a statement of the number of tons they brought into the State. This, added to the quantity manufactured in the State, would have secured the desired information. But getting this statement from only a portion of the Railroads, it was deemed useless to apply to our manufacturers, particularly as failure was anticipated, from the fact that men do not like to make public the amount of their business transacted.

*We believe it has been brought before the courts, and decided in favor of the State.

THE WORK OF THE DEPARTMENT.

Since my last report, the collection of minerals has been steadily progressing, and while not as rapidly as is desirable, I have done all that I could see was practicable with the limited means at my command. The collection is made entirely from voluntary contributions; and among the contributors I desire particularly to thank Dr. Wm. H. Ruffner, who has added many valuable specimens, one department being devoted particularly to an illustration of the Lithology of the State; and I have further to thank him for his valuable assistance in the arrangement and classification of the minerals. My connection with the collection of the minerals of the State has given me an opportunity of forming some estimate of their amount and value, which I am convinced is very great—much greater than I had previously any conception of. They must necessarily be a source of very profitable and long-continued revenue to the State and its inhabitants. I have been particularly struck with the vast deposits of iron existing in a large portion of our territory—not only vast in quantity, but much of it of the very best quality. The quantity is so great as to seem to be practically inexhaustible. We shall have more to say on this subject further on.

My "Fourth Annual Report" of 166 pages was issued in the fall of 1880. Among other things, it contains an analysis of forty-one brands of fertilizers. Some four others were subsequently published in the *Monthly Bulletin*. Besides these, analyses were made of a considerable number of minerals, and some marls of Tidewater Virginia. The *Monthly Bulletin* is a small publication made by Captain R. Irby, agent of the "Bureau of Immigration," and myself, in the interest of Immigration and Agriculture, containing information concerning the resources of Virginia, and the advantages we possess for those seeking new homes; and in the Agricultural Department are found monthly reports of crops during the summer months, and practical observations on agricultural subjects, and analyses. Four thousand copies of the *Bulletin* are issued monthly, and distributed free of charge to farmers, officers of the counties, posted at railway stations, and a considerable number sent out of the State by Capt. Irby, with the view of inviting immigration. Our effort has been to make the publication self-sustaining by means of advertising patronage, in which we have not fully succeeded, though it is doubtless one of the best advertising mediums in the State, going as it does to the best farmers in each county, public officials, and many other individuals. We appeal to the farmers, merchants, agricultural implement manufacturers, those having mineral and other lands to sell, for their patronage to support us in furnishing a useful paper to the farmers free of charge. We have reason to believe that the farmers appreciate the *Monthly Bulletin*, and read it with satisfaction and interest.

Many of the newspapers of the day are sent gratuitously to my rooms, and farmers and others find here not only these, but various agricultural journals, which are also sent free of charge, and we shall always gladly welcome visitors, particularly farmers, who may spend their spare hours in our reading-room and mineral cabinet.

I have thought it best to publish another edition (Third) of the "Hand-Book of Virginia," as it is sought after by our own citizens, and by strangers; and while I have no authority (and if I had the authority postage would be a considerable

charge on my little fund) to circulate it outside of the State, still others get copies, and send them to persons in other States desiring information about Virginia, and I think it not improper to occasionally send a copy to persons thinking of immigrating to our State, and asking information about our resources, climate, and advantages generally. Such publications, if published in large number by the State and properly circulated, would be the means of bringing in many immigrants to buy up and improve our surplus lands—a thing greatly to be desired. Capt. Irby, agent of the Bureau of Immigration, has ordered 2,500 copies of the Hand-Book, with the view of using them in behalf of immigration.

Another edition of this work seemed to be required, as the previous edition was exhausted, and important returns from the census of 1880 required additions and corrections of former statistics. Moreover, many mineral deposits have been discovered and developed in the last year, and it was desirable that the particular counties in which these minerals are located should be credited with them, both on their own account and as guides to those seeking mineral lands and particular ores in the State. Additional information, too, was required regarding our lines of transportation, when speaking of the resources and prospects of the State, as scarcely anything can be a better index of the prosperity of a State than her means of access to markets, and of communication with the outside world. If a country has little of surplus to furnish to other countries, and little to exchange for what it needs in the way of the necessities, the comforts, and the luxuries of life, then that country has little need for railroad and steamboat communications. One travelling in England, the greatest agricultural and commercial nation on the globe, particularly if area and population are considered, is struck with an exemplification of the truth of these statements. The whole country is so intersected with railways, so cut up, that one looking on it, as a plain farmer would do, as simply a great agricultural country, will begin to fear that no land will be left for cultivation; and insurers against railway accidents, if they did not know the system and care with which these numerous trains are run (some of them every fifteen minutes), would begin to fear for the solvency of the companies they represent. The additions to our lines of transportation in the last twelve months is something wonderful. Our great Central line will soon have one of its colossal feet on the Atlantic ocean, and the other, before much time shall elapse, on the great Pacific. The Southern connections we have formed, and are forming, unite our merchants and manufacturers with the revived South, next with the Mississippi river, and soon with the Pacific ocean and the Eastern world. The road which has supplanted our ancient water line, the fond conception of Washington and other great men, has shot itself, in little more than twelve months, from the head of tidewater through the magnificent valley of the James, with its vast mineral and agricultural wealth, to an intersection with the great central line, the Chesapeake and Ohio railroad, beyond the Blue Ridge; but its destiny is beyond the Alleghanies, to the great grain markets of the West, and to the great iron manufacturing centres of Pennsylvania. The whole South is alive to a new destiny, and within a short period one hundred million dollars of Northern capital has been introduced with which to develop the hidden resources of this favored section.

CONDITION OF CROPS, AND AGRICULTURE IN VIRGINIA.

The present year has, as regards crops, been a very unfavorable one for the State. The hay, corn and tobacco are short, particularly the latter. After encountering a severe and protracted drought, on the 5th of October a very unexpected and unusually early frost occurred, and destroyed nearly half the tobacco which was standing; only a small portion had been cut. The frost was particularly destructive on the Southside counties, extending to North Carolina, and even injuring the cotton of South Carolina. In the vicinity of Richmond, strange to say, the tobacco and vegetables were not injured, and we have had no killing frost up to November 15. The writer had tobacco which was not touched by the frost. The hay crop has been very short, and there is little provender in the State, and, we are afraid, little in the United States, and that next winter will necessarily be a trying one on stock, even if we should not have a cold one. We have heard that farmers are already selling off their stock for fear of not being able to winter them. Just before the middle of September we had, through most of the State, quite good rains, which were the first we had had since June, except in limited localities. We thought then the dry weather was over; the late corn and tobacco rallied, and we hoped with a late season there would be very considerable improvement in these crops. But another dry spell supervened, which, with the frost on the tobacco on the 5th, again dampened the spirit of the farmers, and not without cause. Circulars have been sent out to get the condition of crops for the summer months. By the report published in October from about 87 counties, we estimate the corn crop at 55.50 as the average for Virginia (see note on last page of *Monthly Bulletin* for October); wheat, 73.33; tobacco, 49.70; hay, 65.51; cotton, 51.87; oats, 67; Irish potatoes, 64.45; sweet potatoes, 59; fruits, 72.37; peanuts, 60. This is taking 100 as a fair average crop. For corn we do not think this is too high, perhaps not quite high enough, as we are convinced from what we have seen and heard that there is more corn made than is generally supposed. We think wheat is about three-fourths of a crop, particularly taking into consideration the goodness of the grain, and the excellent condition in which it was preserved and marketed, as we suppose most of it has been. The hay and oat crops, we are afraid, are estimated too high, for there has been no second crop of hay cut, and the winter oats were almost all killed. There is very little old hay in the country, and there is so little native grass, owing to the long drought, and the pastures are so bare, that farmers have been forced to begin unusually early to feed dry food to their stock. We have advised farmers, whenever we have had the opportunity (in the *Monthly Bulletin* and elsewhere), to sow as much rye as practicable in the months of August and September to afford some winter grazing for stock, and to use for green forage in the month of April, when it will come in for that purpose, if stock is taken off in time, say March 1st, and it has not been too closely grazed. Winter oats may be grazed also if seeded in August and 1st of September. We have also advised that crab grass, rag weed (coming up after wheat), and coarse grasses about the swamps should be all cut for hay, that wheat straw should be housed as far as practicable, to prevent waste and rotting, and that all the corn stalks be cut down and hacked up until wanted in winter. Wheat straw well housed is worth as much as coarse hays, and cows will get a considerable amount of feed from stalks.

The fall has been so dry that some seed have come up badly, though wheat and oats and rye have come up remarkably well under the influence of the rains and warm fall. There will be scarcely any turnip crop, and cabbage, as far as we have heard, are almost destroyed by drought and cabbage worm—the product of a small, yellow butterfly, “European cabbage fly,” said to have been imported into this country from Europe, by way of Quebec, in 1869. The late Irish potato crop is generally a failure; so that there will be a scarcity of vegetables, as well as of other things; and we are afraid that the hot, dry fall has matured the apple crop so early and imperfectly that it will not keep.

Where farmers have failed to put in wheat, they will have to reserve their land for corn, which they will have time to prepare well, and it may yield them as much, perhaps more, than wheat, which is a very uncertain crop, while corn is quite certain on good land and with good cultivation. We have been surprised to see the result of the corn crop on the lands near Richmond, though we have had very little rain from June to last of October. About the middle of September we had several quite good rains, the effects of which lasted about a week or ten days, and then it was as dry as ever. I have some ears of corn grown this year as fine as will be found any year, and on one piece of good land of four acres the corn is actually better than it was last year. This, however, I attribute to the kinds of corn planted each year. Last year it was a *prolific* variety; this year the large “*gourd seed*,” which is a mixture of the old regular gourd seed with flint corn. This prolific corn, in my observation, is not hardy, does not mature well, and has more rotted, defective, loose-grained ears by far than the large corn, which is hardy, matures well, and has very few defective ears, and is close-grained. Last spring Mr. W. H. Behton, of Loudoun, sent me one bushel of his popular seed corn, which I planted on medium land. I find the ears are of medium size, not so large as gourd seed, just mentioned, but it is well filled at both ends, compact, fine grains, and small husk. No doubt it is an excellent corn to plant.

Another serious effect of the drought has been that the farmers have been unable to seed the usual amount of wheat, and what has been seeded, has been, in many instances, put in hurriedly and without sufficient preparation—a matter of great importance in all crops, but particularly in the wheat crop. The wheat crop this year was $\frac{2}{3}$ of a good crop, or about 75 in quantity (as previously stated), while the quality was unusually good. The price it has commanded will bring up the money value to as much, or nearly as much, as it was last year. The increased market prices of tobacco will compensate in some measure for the shortness of the crop. But where farmers have to buy corn, which is obliged to be high, it will take all profits they can make on other crops. The United States Department of Agriculture estimates the corn crop of the United States at 60 (on September 1st); wheat, 70; for tobacco, 65; cotton, 72. The same Department (U. S.) estimates for Virginia corn at 63; wheat, 78; tobacco, 68; cotton, 72. I may observe here that I receive returns from about 90 counties, while the United States Department does not receive them from quite half that number. By my returns, cotton for Virginia is estimated at 52; hay, 65; oats, 67; peanuts, 60. The cotton crop in Virginia is increasing very decidedly, and quite a number of counties are raising it for the first time. At one time it was very promising, and we hope the estimate may be rather low. The quality of Virginia cotton is said to equal that of any other State. We are afraid the estimate for hay and oats are too high, for oats particularly, as the winter oats were mostly killed, and the spring oats were indifferent, as they generally are, but more so this year than usual.

While on the subject of crops, it will be interesting to refer to the census returns for 1880 of the cereals of Virginia. The corn crop amounted to 29,106,661 bushels; wheat, 7,882,504 bushels; oats, 5,333,181 bushels; rye, 324,431 bushels; buckwheat, 136,004 bushels; barley, 14,223 bushels. We have not received the returns for tobacco, hay, potatoes, &c.

For the United States, the corn crop amounted to 1,754,861,535 bushels; the wheat crop to 459,479,505 bushels; oats, 407,859,999 bushels; barley, 44,113,495 bushels; rye, 19,831,595 bushels; buckwheat, 11,817,327 bushels.

Of the States, Illinois raised the most corn, viz: 325,792,481 bushels; Iowa next, with 275,024,247 bushels; then Missouri, 202,485,247 bushels; then Indiana, 115,482,300 bushels; then Ohio, 111,877,124 bushels; then Kansas, 105,729,325 bushels; Kentucky, 72,852,263 bushels; Tennessee, 62,764,429 bushels, &c. Of the Southern States, next to Virginia comes Alabama, with 25,451,278 bushels; then Georgia, 23,202,018 bushels. Pennsylvania raises 45,821,531 bushels. Of wheat, Illinois raises most, viz: 51,110,502 bushels; then Indiana, 47,284,853 bushels; then Ohio, 46,014,889 bushels; Michigan, 35,532,543 bushels; Minnesota, 34,601,030 bushels; Missouri, 24,966,627 bushels; Pennsylvania, 19,462,405 bushels; New York, 11,587,766 bushels, &c. California raises 29,017,707, coming before Missouri. Illinois, again, raises the most oats. Pennsylvania the most rye (Illinois being nearly equal). California the most barley, New York being next, and then Wisconsin. These statements are interesting, particularly by way of comparison with what we are raising in Virginia.

The *Peanut* crop is an important one in many of the counties of Tidewater Virginia, south of James river, and is attended with considerable profit. Virginia raises more than any other State—the crop being worth at least \$500,000 (estimate of 1879)—then N. C., then Tennessee—these being the only States which raise them for market. Lime or marl are indispensable to the successful cultivation of this crop. I have given their mode of cultivation, as well as that of all of the principal crops of the State, in a former report (Fourth Annual). The sweet potato crop is another important crop in Tidewater Virginia. The cultivation of that usually goes hand in hand with that of melons, the same kind of soil suiting each. The crops have been profitable this year, some other vegetables and fruits having been scarce. Some of the farmers in Hanover county have realized more than \$100 per acre from these crops. The potatoes have also been profitable on the Eastern Shore, and no doubt in other counties. Irish potatoes are not raised extensively in the State for market. They succeed admirably about the foot of the mountains and on the mountains, and do well in all the cooler sections of the State. In Tidewater Virginia they can be raised early for market, and are shipped considerably from the vicinity of Norfolk. The second crop does not do well in Eastern Virginia on account of hot suns and not enough moisture. For the same reason, “root crops” do not usually succeed in Eastern Virginia (Tidewater and Middle Virginia). They are not much attempted for stock in Piedmont and the Valley, as the farmers usually have hay enough, and frequently have winter grazing from orchard and blue grass, when the snow is not on the ground and the winter is not very severe. There is one root crop which we think has been neglected, and which we think will succeed well on all the light, good land in the State, viz., artichokes. They are very productive on light, loamy lands, near the streams, but are productive on all rich land of almost any kind. I have referred to them before, and mentioned that I made at the rate of 1,800 bushels in my gar-

den, chocolate soil, which had been made rich by stable manure and an occasional dressing of ashes. Analysis proves them to be nearly equal to Irish potatoes in nutritive value, and they do not require, as the latter do, the trouble and expense of cooking. Hogs and cows are both fond of them, and they keep perfectly in the ground all the winter. They do not keep well housed, but no doubt would keep in a cellar below the surface, if spread out and covered with sand or dirt, so they will not heat. They are planted in the fall, whole, or in the spring, cut, like Irish potatoes, giving them rather more room, particularly in the drill. They require only two or three workings with the cultivator. The variety I planted was the "White French." In the West the Red Brazilian seems preferred for stock, but the White French is more crisp and tender. It is probable that the common varieties found scattered through the country, if cultivated, is as productive as either.

The *Cabbage* crop in Virginia is, as last year, almost an entire failure, at least in Eastern Virginia. It failed last year in almost the whole State, and we are afraid has been equally a failure this year. This is caused by a caterpillar, the egg producing which is laid by a butterfly (Lepidoptera). The American butterfly has white wings, the tips of the upper ones being yellowish, while the rape, or European cabbage fly, has yellow wings, with the body mostly black in each. The former produces caterpillars said to feed on the leaves, and to be less destructive than the caterpillars of the latter, which goes into the heart of the cabbage, where scarcely anything can reach them. We have both, and, whichever may do the most mischief, between the two the plant is riddled in every direction, and destroyed. These cabbage worms are from one to one and a quarter inches long when fully grown, are green, with yellow stripes and dark spots, though these spots and stripes are only seen when the skin has been cast off (moulting) the first time. Various remedies have been proposed for their destruction, as dusting with air-slacked lime and tobacco, bran, Persian powder, catching the butterfly in the evening with nets, &c.; but after they get established in the cabbage it is doubtful whether any remedy will do good. The lime and tobacco might, if used before the eggs are deposited; but the raisers of cabbage seem to despond when they see their cabbage attacked, and give them up as lost. If the pest continues, and a remedy is not found effectual, the cultivation of this crop had as well be abandoned in this section. If these remedies are used in time, before the egg is deposited, and while being deposited, they may be successful. The Persian powder we do not think will destroy insect life, unless in confined places, where access of fresh air is prevented. While we are having in our Richmond market, from the North, very fine cabbage, and which are also very high in price, the cabbage worm has been very destructive in the Northern States. Packard (on Insects) says: "About Quebec it annually destroys about \$250,000;" and it is estimated by a correspondent of the *American Agriculturist* (November, 1870) that the destruction of cabbage about New York city by this insect will annually exceed a million of dollars.

GRAPE CULTURE AND WINE MAKING.

Grape culture and wine making has assumed encouraging proportions in Virginia--and is on the increase, particularly in Piedmont Virginia, in Albemarle, Nelson, Prince William, Warren (in the Valley), &c. A very considerable quan-

tity of wine has been made by different parties of excellent quality, though the business is yet in its infancy, only commenced a few years since, and in many instances not followed up with intelligence and energy. In California, wine making is assuming much importance, and is destined to be a great interest in that State. A few years since the *State Register* of California estimated the number of vines to be 1,500,000. Now it is estimated by another California paper that there are 50,000,000. In 1875 France produced 2,190,000,000 gallons of wine, and by the end of the present century the *Record* says some best informed on the subject estimate that California will rival the present production of France. To show what a great industry this is, if we suppose that the wine raised in France sells for twenty cents per gallon, we find what a great revenue this is to the country. And we allude to these countries because Virginia is nearly in the same latitude with California, San Francisco and Richmond being on nearly the same parallel, and because France and Virginia have nearly the same climate, though not the same latitude. The climate of California is drier than ours, but our *falls*, the time of ripening of the grapes, are sufficiently dry. And no doubt our climate is sufficiently warm, for grapes succeed better in Piedmont than they do in the warmer temperature of Tidewater and Middle Virginia. California Clarets are quoted by the "American Wine and Grape Grower," in its reports of New York markets in 1879 at 50c. to \$1 per gallon, and the demand is much greater than the supply, while Southern and Western Concord and Catawba are 80c. to \$1, and Norton's Virginia \$1.10. These are the prices in bulk; in cases they run about with the ordinary French Clarets we drink in this country, viz., \$3 to \$6 per case of one dozen. This speaks well for Concord and Norton's Virginia; which is a native grape (being derived from Hanover, Va.) Frenchmen of intelligence who have travelled through our State have expressed the opinion that the portion of it trending along the Eastern base of the Blue Ridge is as well adapted to grape growing as any portion of France. I have in my mind an inhabitant of France, once a resident of Richmond, who examined the country stretching from Charlottesville to Lynchburg, and said of it that if sheeted with gold, that it was so well adapted to grape culture and wine making, it could not be more valuable than it was. We have lately drank California Claret and the Claret of the Monticello Wine Company, Albemarle, and have no hesitation in pronouncing them superior to French Claret. They have less acid, and more body; of the two, we thought the Monticello wine was rather best. In 1878 one case of 12 bottles of this wine was sent to the Paris Exposition, through the Agricultural Department at Washington, who took charge of it, and though it had no one to represent it or sound its praises, it took the only silver medal awarded for wine. Mr. Rierson, the Superintendent of the Monticello Wine Company, in speaking of this in a letter addressed to me, says, "Without any one being interested to bring this pitiful dozen, surrounded as it was by splendid pyramids of casks, cases, and bottles of other exhibitors, to the attention of any one, it has thus passed the crucial test under the most unfavorable circumstances. It certainly not only established itself, but drew attention to this section of country as one eminently fitted for grape culture." Since this time this Company have been doing quite a large business, and are constantly receiving orders for their wine from Northern wine dealers. Mr. Wm. Hotopp, of Albemarle, has a large vineyard and makes nearly ten thousand gallons of wine per annum. Dr. Cadmus, Orange county, Lentz & Co., and F.

Baier, Nelson, and Wm. Heuser,* Prince William, and perhaps others in this section, have large vineyards and are yearly turning out good wines, and the acreage in grapes is largely increasing. Persons raising grapes in this region sell them to the wine makers, and realize about \$100 per acre. The wine brings from 80c. for "Red Concord" to \$1.50 for "Norton," in small lots, but to the trade there is a large deduction, and the grocers are now retailing the Norton Claret at \$1 per gallon. As an evidence of the adaptation of Middle Virginia, and we may say the upper portion of Tidewater, for this industry, we mention Dr. Gilmer's vineyard two miles east of Richmond, where the Dr. makes excellent wine, Norton, Concord, and some (light colored) of Herbemont, and also very good grape brandy. In Lunenburg there are 25 to 30 acres in vineyards, most of them Concord, and good wine is being made, though most of the raisers of grapes ship them to Richmond and Petersburg. In lower Tidewater, grapes are said to mature too early for wine, as they do not have time to form a sufficient amount of sugar. Mr. Albert Dodge, Norfolk county, reports that he raised from $1\frac{1}{2}$ acres of Concord, on sandy loam, 10,000 pounds of Concorde, selling for \$500, and from $\frac{1}{2}$ acre of Martha 1,000 pounds, selling for \$70. And Mr. J. E. Baker, of the same county, from 48 acres sold \$2,900, this being from one-fourth the Ives (18,000 pounds) the rest being made into wine. Grapes around Richmond succeed admirably, particularly Concord and Norton. Native grapes flourish all through Tidewater, particularly the upper half of it, and we have seen old vines through this section of great size, age, and vigor. Muscadines (sloes), of which the Scuppernong is a variety, flourish on the rivers of Tidewater, and mature their fruit well. For some time the impression prevailed that the Concord grape would not make good wine. This is a mistake, and we find now it will make good Claret, and also a white wine, when not fermented on the lees. Moreover, it possesses the valuable quality of keeping well. We have seen a cask of Concord Claret made in North Carolina, which was retailed out by a house in Richmond, through a period of several weeks in the summer, and the last gallon was as sound and as free from acidity as the first, a test which French Claret would not stand; that will become sour in a few days if exposed to the atmosphere.

We can see no reason why Virginia should not become a great wine producing State and derive much revenue from it. Wherever in the State wine making has been attempted with any skill, it has succeeded. This is a favorable time to inaugurate the industry on a much larger scale, as the Phylloxera is devastating the vineyards in France to such a degree as greatly to diminish the production of wine. Then the farmers have of late years been losing money on wheat and tobacco, as they know by sad experience, and it is time to attempt something else. Much of Virginia is not adapted to wheat: even could we raise 15 bushels to the acre, there is very little profit in it, as it costs \$5 or \$6 per acre to raise and get it ready for market, but as it is we average only about $8\frac{3}{4}$ bushels, as the crop on 900,807 acres amounts to 7,882,504 bushels (census of 1880). We do not make a very good showing on corn either, as on 1,767,567 acres we make 29,106,661 bushels, or between 16 and 17 bushels, or about $3\frac{1}{2}$ barrels per acre, and of course there can be but little profit in this for the whole State, though every farmer should endeavor to raise corn enough for his own use and try to find some money crop that will pay better than wheat or else turn his attention to stock and grass.

* Mr. Heuser writes me (1879) that there are in his neighborhood fifty acres in grapes, and that they are daily increasing—that last season some 25,000 pounds of grapes were shipped to Northern markets, and 12,000 gallons of wine were made, representing 180,000 pounds. The wines resemble the French Claret, and those of the Rhine, as White wine or Hocks.

In a report from the United States Agricultural Department on the statistics of grape culture and wine making in the U. S. (1881), the area in vines in Va. is put down at 2,099 acres, wine production 232,479 gallons, and in value \$200,045. We doubt whether this is very correct for Virginia; the production of the different counties is put down. Lunenburg is credited with only four acres; a correspondent writes me word that there are in this county twenty to twenty-five acres. Hanover is credited with one hundred acres and Henrico with sixty-six, while I am certain Henrico has double what Hanover has. These things show the importance of our government giving us the means of getting correct statistics of our productions. In the report referred to California is put down as having 32,368 acres in grapes, with a production of 13,557,155 gallons, worth \$4,046,865.

CONDITION OF STOCK.

We are afraid the condition of stock in the State cannot be very good, though as far as we can learn it is in good health. From the small quantity of hay left over last winter, the small crop raised this year, and the scanty pastures, the effect of drought, stock must enter upon the coming winter in thin condition, whereas they should, if possible, go into winter quarters in good condition. We hear that considerable amount of stock is being sold off already, in anticipation of short supply of forage; and this is proper, where the farmer cannot winter his stock without being in a half starved state. But the next year and winter the deficiency must be felt, and it will be some time before it can be made up, and purchases must be at greater prices than those received for stock sold.

The quality and quantity of stock in the State has been gradually and steadily improving, which has been particularly marked in quality. For a long time Virginia has been noted for good horses of good blood; in a degree to surpass any other State. John Randolph as a pioneer, followed by William R. Johnston, John M. Botts, the Doswells and others, have given to the State some of the best bred and finest horses known in the United States, if not the very finest in the whole country. This blood has probably not been sufficiently diffused, being confined too much to Eastern Virginia. We have long thought that there was not enough of "blood" in the horses of Piedmont, and the Valley, and mountain regions, though of late years admixture of well bred horses has increased in these sections. While in rough, rocky, mountainous regions and in clay soils, with grass sod, heavy horses are necessary, some blood, which imparts activity of movement and quick step with less fatigue, though it will be with diminished size, is very desirable. There is undoubtedly more endurance in horses with some improved blood than in heavy, awkward, clumsy moving animals, which expend much of their force in moving their heavy bodies and big limbs. While we do not advocate small horses for these sections, we believe a medium-size horse is best with some admixture of good blood. The immense dray horses used in English towns, also in our towns, though of less size, do not prove the propriety of the use of overgrown horses on our farms. There (in the towns) they wish immense weight moved small distances over level streets. While on farms, we wish quick step in ploughing, quick step in turning around, quick step in hauling moderate loads of loose provender, and quick step in going to and from mill with moderate loads, quick movement for the family carriage, and a quicker movement when going for the family doctor, &c.

The exhibition of stock at the late State Fair proves that there has been no decline in well-bred stock in Virginia, and while the condition of stock exhibited is not a fair criterion of the average condition of stock, because the former were fed and prepared for show, still there was a fine display of horses, cattle, sheep, and hogs, well kept and in excellent order. Among the horses, the racer, the roadster, the saddle horse, the stallion, and brood mare were all well represented. Among the cattle there were fine specimens of almost all the different breeds. We noticed the absence of the "Holsteins," which were present at the last two fairs, which would seem to indicate that they are not increasing in popular favor, though they have been highly praised, and doubtless have some good qualities and are larger milkers. The cattle were in the best condition, and the fat cattle were very fat, particularly those from the southwest portion of the State. There were as fine milch, brood cows and bulls as can be seen anywhere. Almost all the breeds of sheep, with their grades, were to be seen in large number, and among them some very fine sheep. The show of hogs was not so large as usual. We noticed particularly the absence of Major Venable's fine herd, and also that of Mr. Fulford's, which at previous fairs attracted much attention. The latter however are from Maryland. Still there were fine hogs of all the leading breeds. The introduction of so much well-bred stock into the State has already much improved the common stock, and must continue to improve it rapidly, a thing greatly to be desired, for we shall have diffused into every part of the State good animals, which will cost no more to sustain than the numerous scrubs which now in many instances disgrace our fields.

There has been a decided increase in the number of farm animals in almost every county since the census of 1870. The enumeration for each county in 1870 and 1880 is given in the last edition (1881) of the "Hand-Book of Virginia."

The health of stock is good, as far as can be ascertained. We have heard little of Hog Cholera during the year.

PLEURO-PNEUMONIA.

Some time since the Governor of Virginia received a communication from the United States Department of Agriculture, inquiring into the existence of pleuropneumonia in Virginia, saying that it was reported that cases existed in the State. The Governor referred the communication to me for investigation and report. I immediately wrote to many prominent farmers and cattle-breeders in different sections of our State, and received numerous replies, communicating the gratifying intelligence that this disease no where prevailed in our borders. The last case heard of was in the dairy of Colonel George Johnston, near Alexandria, and that was last December.

Since writing the above I have just seen a paragraph in one of our papers, copied from Lynchburg and Staunton papers, saying that a strange and fatal disease is existing among the cows in their respective neighborhoods, and that the disease has proved fatal to a large number of cows about Staunton. It is also stated by the Wytheville *Enterprise* that a large number of milch cows have died from a new disease that has made its appearance there. It is called by some "Carolina Fever." The symptoms are not described, and we do not know its character, or whether the disease is the same in the different localities referred to. We have applied to some prominent farmers for information on the subject.

Later.—We have reserved a blank here for this information, and have received the following from Colonel Statham, who writes as follows :

“LYNCHBURG, November 2, 1881.

“I have made inquiries of many persons in this city as well as in the vicinity, including butchers, gardeners, and market men generally, and also of the farmers, and all concur in saying there is no disease among cattle now, nor has there been this year. Bedford, Campbell and Amherst farmers represent cattle as uncommonly healthy and looking better than usual. The trouble is food to carry them through the winter.”

I have also received a letter from Hon. A. Kolner, of Augusta, who said an epidemic disease had prevailed in that section called by some “Dry Murrain,” supposed to be due to scarcity of water and grass owing to the drought, but that it had entirely subsided.

COMMERCIAL FERTILIZERS.

We present in this report analyses of thirty-seven fertilizers made by Professor Taylor, State Chemist, and chemist to this department. They were published from time to time as they were made in the “Monthly Bulletin,” and distributed to the farmers individually, and to Farmers’ Clubs in the State. It is to be regretted that I have not the funds to have all the fertilizers sold in the State analyzed. The mode of determining the value of a fertilizer is one of considerable difficulty, and is constantly exercising the thoughts of farmers. The varying circumstances attending their use, as good and bad seasons, suitability or non-suitability to particular soils and crops, the differing and inferior qualities of fertilizers, have caused farmers to arrive at different conclusions, some thinking them of much value and very necessary to successful farming, while others condemn them as cheats and humbugs, and as inflicting great losses on agriculturists. There is no doubt, but what farmers have, from various causes, lost much by purchasing fertilizers. The principal of these causes, as far as we can judge, have been inferior fertilizers, injudicious use of them, dry summers, the many indifferent wheat crops, and of late years the depressed price of tobacco, and though the prices are now good the farmers have but little to sell, and that injured in quality by drought and frost. That analyses have improved the quality of fertilizers there can be no doubt. It is very rare to see a really indifferent or worthless article offered now to the public, because manufacturers know that the chemist’s tests will find it out.* Manufacturers of established reputation, and those wishing to establish a reputation, besides knowing it is to their interest to maintain a good quality for their brand, also know that analyses will show what that quality is, and bring them in comparison with other fertilizers. Analyses also test the correctness of the labels that manufacturers are required by law to put on their bags. Not unfrequently a farmer buys a fertilizer, and its not acting well, naturally begets a doubt that it is not what it is represented to be, and it is straightway sent to this department for analysis, to determine whether it comes up to its representation. In some cases it does, and in others does not, and in the latter case the farmer is absolved from payment. Here we remark that farmers should see this label before purchasing.

* This has been done by this department and other departments, and the manufacturer forced to withdraw it from market or add to its value by improving its quality.

If analysis proves that the label fairly represents what this label claims, he has no redress at law, unless the manufacturer should have given some written guarantee that his fertilizer will produce such and such effects upon crops, which he is not at all likely to do. Its not acting favorably upon crops is not admitted as evidence by the courts if the label is shown to properly represent the constituents of the fertilizer.

VALUATION OF FERTILIZERS.

To give even the *commercial* valuation of fertilizers is a very difficult matter, and to give the *agricultural* value in money is impossible. The commercial value varies from time to time, as do other articles of trade; and the source from which manufacturers derive the ingredients makes a great difference in the cost—double, and more than double, in some instances over others. Unfortunately, chemistry cannot tell the source of these ingredients.

We give a table of valuations obtained this year from the Connecticut Experimental Station, Dr. S. W. Johnson, director. He gives the values for 1880–81 :

COST OF ACTIVE INGREDIENTS OF FERTILIZERS DURING 1880, AND TRADE-VALUE ADOPTED BY THE STATION FOR 1881.

	Average trade-value for 1879–80. For 1881. Cents per pound.	
Nitrogen in nitrates.....	26	26
“ in ammonia salts.....	22½	22½
“ in Peruvian guano, fine steamed bone, dried and fine ground blood, meat and fish, superphosphates and special manures.....	20	20
“ in coarse or moist blood, meat or tankage, in cotton seed, lindseed and Castor Pomace.....	20	16
“ in fine ground bone, horn and wool dust.....	18	15
“ in fine medium bone.....	17½	14
“ in medium bone.....	16½	13
“ in coarse medium bone.....	15½	12
“ in coarse bone, horn shavings, hair and fish scrap.....	15	11
Phosphoric acid, soluble in water.....	12½	12½
“ “ “reverted” and in Peruvian guano.....	9	9
“ “ “insoluble, in fine bone and fish guano.....	7	6
“ “ “in fine medium bone.....	6½	5½
“ “ “in medium bone.....	6	5
“ “ “in coarse medium bone.....	5½	4½
“ “ “in coarse bone, bone ash and bone black.....	5	4
“ “ “in fine ground rock phosphate.....	3½	3½
Potash in high grade sulphate.....	7½	7
“ in low grade sulphate and kainite.....	6	5½
“ in muriate or potassium chloride.....	4½	3½

Here is an evidence of what we have just stated above—viz., the great variation of cost dependent on the sources whence obtained. But we give this table more especially to put farmers on their guard, that they must not take it for granted

that they can afford to pay such a price for a fertilizer as marked down as its commercial value. Even if we have the source of the ammonia, the phosphoric acid, and the potash, and what they cost the manufacturer, still we cannot say this cost is a guarantee to the farmer that he can pay that much (cost price) for the article. Some lands do not require the ammonia, such as have had fallows, and are full of vegetable matter. Some do not need potash, such as good red-clay soils, and new lands, and some require more phosphoric acid than others. Some years since, in the county of Caroline, a fertilizer with a liberal amount of phosphoric acid, fired the corn badly in a dry season, and the purchasers refused to pay for it. If the fertilizer had had half the amount of phosphoric acid such a result would scarcely have occurred, as light lands such as those in Caroline will not bear a full amount of phosphoric acid without firing. How are farmers, then, to be guided in their use of fertilizers? What a fertilizer cost the manufacturer, if it could be ascertained, is no doubt a general index of its value, subject to many exceptions. An examination of the tables of analyses, and ascertaining how much ammonia, phosphoric acid, and potash (the three important constituents), are contained, and comparing each fertilizer with the others, are the best modes of determining the value of a fertilizer. It is not so much a question as to how much the fertilizer cost the manufacturer as how much ammonia, phosphoric acid, and potash they contain. The manufacturer might, in some instances, get his ingredients at half price, and they would be worth as much to the farmer as if the manufacturer had paid full price. Let the farmer learn how much of these ingredients are usually found in fertilizers of established reputation, and that have been tested on crops, and compare all in a table by some such standard, and then let him think about his soil and its condition. As I have said, if the land has had much vegetable matter turned in, or that has been falling on it and accumulating for some years, he can do with little or no ammonia. If the land is good clay, or chocolate land, or new land, he may do without potash; and if it is very light land, let him be cautious he does not put too much phosphoric acid on it, fear of firing his crops in the hot dry summers.

Farmers, too, should test fertilizers in small quantities as far as they have the opportunity; for instance, obtain strips of land of same measurement, leave out first one, and then another ingredient, and then two, and then use all three on another strip, and compare the results, and repeat the experiments for several years, obtaining advantage of different seasons, and probably of lands that vary in character, and valuable results will be obtained, and particularly if several neighbors will unite in these experiments.

Farmers rely too much on the commercial value of fertilizers, and some seem to consider this the "gist" of analyses, and I have heard the remark that if the commercial values of fertilizers could not be ascertained, that analysis was of no value. A great mistake, as we think, has just been demonstrated. These values are a secondary, subsidiary question. I have said to farmers in my reports, and tables of analyses sent out, that available ammonia is generally estimated at 18c.;* phosphoric acid, available, at 12c., and potash at 7c., and insoluble phosphoric acid 5c., and that they can make on this basis the value of a ton of fertilizer by multiplying the percentages considered as pounds by the value per pound—this would give the value of 100 pounds, and this by twenty, of a ton. For instance, if there is 10 per cent. of phosphoric acid, this multiplied by the cost per pound,

*Ammonia should probably be put at 20c., as it has risen in value.

12c., would be \$1.20 per one hundred pounds of the fertilizer, and this by twenty would be \$24 of cost in a ton of this particular constituent—and so of the others, and the total would be the total commercial cost of a ton. Some prefer I should make the calculation for them, which I do, with the understanding that I do not say the ammonia, phosphoric acid and potash have cost the manufacturers, respectively, 18, 12, and 7 cents (though this may be an approximation, and will serve as some comparison between the cost of fertilizers), and that the fertilizers are worth the commercial valuation thus obtained, and that the farmer can afford to pay this price, or more. Some persons seem to desire the Commissioner of Agriculture to say over his signature that such a fertilizer is worth so much, and that we can afford to pay that for it. This in the nature of the case cannot be done. It was not designed that the Commissioner of Agriculture should select and particularize by name what fertilizers the farmers should use, but that he should guarantee them against fraud and prevent adulteration by seeing by analyses that every brand contains just what it claims to do, or at least that it shall not fall below what is labelled on the bags.

The analyses of fertilizers are of course made as found in trade, not dried, and the chemist analyzes by numbers, not knowing the brand he is analyzing, so as to remove all possible suspicion of favoritism.

I have added the "insoluble" phosphoric acid at 5c. per pound (about the average of the valuation from the different sources), though, we think, less than it is worth, particularly for wheat. In some cases, Ground Bone and South Carolina Phosphate to which no acid has been added, applied to the wheat crop in the fall, seems to have acted equally as well as the Dissolved Bone—the two former containing insoluble, and the latter Soluble Phosphoric Acid. Some think the two former act best.

Many things have to be taken into consideration in selecting and using fertilizers, some of which have been referred to in former reports. The subject is so important, and it being very necessary that farmers should not act in the dark in the use of these agents, is my reason for again recurring to it. Even if some things in reference to them are repeated, it will not be useless, as farmers frequently forget what they have heard on the subject, and by being presented in different ways and in different words the subject may be better comprehended.

When we compare the insoluble with the soluble phosphoric acid, of course the ground bone not subjected to heat is more valuable than the ground South Carolina phosphate, as it contains 4 to 5 per cent. Ammonia, while the South Carolina phosphate contains none. This makes also the ground bone more valuable than the dissolved bone, which, having been subjected to heat, has lost its Ammonia. Unless speedy action is desirable, the ground bone and the South Carolina phosphate being slower in action, seem to come into play at a good time for the maturing and filling of wheat.

The *fineness* of both the ground bone and the South Carolina phosphate is an important consideration, as the finely ground is more rapidly disintegrated in the soil and more quickly assimilated by plants than the coarse. If coarse, a much larger quantity should be used, as in a large quantity there will be some fine portion which will come sooner into play. We remember using some coarse ground bone one year on oats followed with clover. We saw no effect from it, and have seen none since. Probably its action has been so slow and gradual as not to be perceptible at any one time, and, besides, the land has not been in clover except

two years following the application of the bone, having been planted in an orchard and cultivated since in corn. We have heard that some farmers, notably in Pennsylvania, think they can afford to put on their lands one ton (2,000 lbs.) of coarse ground bone, which will be gradually decomposing, and will furnish all the phosphoric acid the land will ever need, or at least in an ordinary lifetime of the farmer. But we think it is poor economy, and that it is better to put on occasionally 200 lbs. of fine ground bone or South Carolina phosphate.

The phosphoric acid is the most indispensable of all the constituents of fertilizers. As said before some lands may do without Ammonia, and some without Potash. Much land has a large proportion of Ammonia, and many plants, particularly the Leguminous, abstract it from the atmosphere. Nature has supplied many soils with a good quantity of Potash. Lawes and Gilbert say the English soils rarely require Potash, and the Turnip crop, which is so important a one in England, and though the Turnip has about four times as much Potash in its composition as it has of phosphoric acid, the latter is almost the only fertilizer used for its production on English soil. Phosphoric acid is important for all plants and all soils. There is not a plant that does not contain it, and being found in large quantity in plants, and in small quantity in soils, is soonest exhausted, and therefore has to be replaced by the phosphates and superphosphates of commerce. "It occurs in nature in forms almost exclusively in forms not assimilable by plants, and even when taken up by them and converted into organized bodies, whether animal or vegetable, the same insoluble forms are assumed. Thus the bones of all animals and the seeds of all plants have in large proportions phosphoric acid combined as the insoluble trivasic, or bone phosphate of lime, which, in that form, would remain unappropriated by plants, unless changed by slow chemical action in the soil." (Prof. Pendleton). The necessity that plants should contain Phosphoric Acid is made evident when we remember that the bones of all animals are made up of this material combined with lime. The milk, too, contains a large portion of Phosphate Lime, and from this is formed the bones of all young animals. This process, it is true, is commenced before birth from the mother's blood, but the bones are in a soft condition, and could never be hardened or perfected without the agency of the milk. In the cow every 30 gallons of milk contains one pound of phosphate lime, and it is estimated that a cow in milk requires about 80 pounds of bone material in a year, and thus a herd of twenty-five cows will carry off by pasturage, and from the hay fed in the stalls, one ton of bone material in a year. This drain upon the resources of the land cannot continue for a very long time without rendering the fields poor and unproductive, and Phosphate Lime must be returned in some form to feed the grasses and impart the qualities necessary to nourish the bodies and form the bones of our stock, which, in turn, are used to form our own bodies and bones. The farmer, then, in selecting Fertilizers, must see that they contain a good percentage of Phosphoric Acid. The mechanical condition of Fertilizers should be looked to. Plants cannot assimilate Bone in its ordinary state, and it must be rendered soluble in water before it can be taken up by the plant, which is done by very *fine* grinding, making "Bone Flour," or, by dissolving by Sulphuric Acid ("Oil of Vitriol"), Bone or Phosphate rock (of South Carolina), constituting the "Superphosphate of Lime," or "Acid Phosphate," or "Dissolved Bone," all of which mean the same thing. Unless the Bone is fine, its action is too slow for growing crops unless a large quantity is used, though it will show its effects on future crops. By dissolving it by the Acid

its action is much more rapid and active, but there is something lost by this in the expense of the Acid, loss of time and labor, and loss in the percentage of bone. Besides this, nearly two-thirds of this dissolved bone is Plaster (Gypsum) formed by the union of the Sulphuric Acid with the lime of the Phosphate of Lime, and this is a loss except to those soils which are acted on by Plaster. When used in compost it is useful in preventing escape of the Ammonia of putrescent manure used in the compost.

Prof. Ville, of Paris, by his experiments at the Government farm at Vincennes, during the last twenty-five years, has attracted much attention by his system of manuring. By some his theories and practice have been highly commended, while others have expressed doubts about them. We suppose he has accomplished something, and added to our information about Fertilizers, their application to particular crops, mode of action, &c., while he has probably propagated some erroneous opinions and committed some mistakes. According to his teachings of the dozen or more constituents of dung, *four*, nitrogen, phosphate lime (Phosphoric Acid), potash and lime, which constitute about one-tenth of its weight, are "the regulators, *par excellence*, of production, and are the only ones with which agricultural industry need occupy itself." His formulas for "complete manures" supply these four ingredients, viz: Nitrogen, as Nitrate of Potash (Saltpetre), Nitrate of Soda or Sulphate Ammonia; *Phosphoric Acid*, in the form of Superphosphate; the *Potash*, in either Nitrate of Potash or other potash Salts, and the *Lime*, as Sulphate of Lime (land plaster). He says that "the mixture of these substances has the same properties of dung. The complete chemical manure is to barn-yard manure what the metal is to the ore—it is a farm-yard manure divested of all useless matter; no one can do any good without the co-operation of the other three (though if either is supplied in abundance by the soil, it need not be included in the manure). Given the others, and each has its own predominant action for a certain list of crops." This seems an extreme statement, that one of these things can do no good without the others, which may be supplied by the soil. On the sand banks of New Jersey, with scarcely any vegetation, clover and peas, and afterwards other crops are made to grow by the use of Potash in the "Green sand"—the Ammonia being derived from the atmosphere. Where the phosphoric acid would come from in such a soil is hard to tell, though there is some Phosphoric Acid in the Green sand—a little more than $\frac{1}{2}$ per cent.—and there may be some in the soil. But, perhaps, Prof. Ville intended to include the atmosphere along with soils as a source of supply of Ammonia at least.

Ville, in his system, gives the name "*dominant*" to the ingredients, which, for a given crop, plays a more important part than the others, thus—

"*Nitrogen* is the predominant ingredient for the Cereals, as Wheat, Barley, Rye, Oats, and for Colza, Sugar Beet, Hemp, &c.

"*Potash* has a special influence upon Peas, Beans, Clover, Lucern, Flax, Potatoes, &c.

"*Phosphoric Acid* is especially beneficial for Turnips, Ruta-Bagas, Radishes, Indian Corn, Sugar Cane, &c.

"*Lime* seems to exert no special preponderating action on any plant, but is necessary for all."

We suppose he refers to Gypsum (Sulphate Lime). If he refers to Lime as Carbonate, then we say it acts *chiefly*, not entirely, by decomposing vegetable matter and also minerals, and making plant food available. Now Phosphoric Acid seems

particularly needed for wheat, and has an excellent effect upon the Grasses, on the Grape, and, indeed, upon almost every plant.

Prof. Atwater, from whom we have quoted them, in commenting on these dicta of Ville, without expressing any opinion of their truth or exactness, says :

“The practical inference is that in preparing a fertilizer for a given plant, we must reduce the subordinate ingredients as much as we can, and put in a good deal of the dominant. To sustain his propositions, Ville cites a great many experiments, some made by himself in pots or in the fields of the Experimental Farm at Vincennes, and others by farmers in France and elsewhere. From these experiments, Ville infers that nitrogen is the dominant ingredient for wheat and the sugar beet, and consequently he puts a large proportion of it in his formulas for these crops. He insists, furthermore, that the form of combination is important, and uses sulphate of ammonia for wheat, nitrate of soda for sugar-beets, and so on. For clover, beans, peas, etc., he recommends little or no nitrogen, because the plants are found to get very little if any good from nitrogenous manures. He explains this by assuming that such plants get all their nitrogen from the air, and do not need it in fertilizers. Of the theory once held by many, that plants assimilate the free nitrogen of the air, Ville has been for some years almost the only prominent defender. He claims that clover gathers all its nitrogen from the air; that barley and rye get 80 per cent.; wheat 50 per cent., and sugar-beet 60 per cent. from the air, and the rest from the soil.”

Prof. Atwater goes on to say—rather an unfavorable comment on Prof. Ville :

“But by far the most valuable contribution to our knowledge of these subjects comes from the classic

EXPERIMENTS BY MESSRS. LAWES AND GILBERT, IN ENGLAND.

“In their experiments, wheat, which has for thirty years received mineral manures alone, has averaged $16\frac{1}{2}$ bushels per acre yearly, against 14 bushels unmanured. The addition of sulphate of ammonia, with the same repeated cropping of the same land, brought the average up to 36 bushels per acre. The leguminous crops have told just the opposite story. Though they contain a good deal more nitrogen than wheat, they respond but slightly to nitrogen, and are greatly aided by mineral manures. In an experiment on the mixed herbage of grass land, continued through twenty years, mineral manures without potash brought up the total crop 47 per cent., and the nitrogen in the crop 38 lbs. per acre annually above the unmanured. And when potash was added to the mineral manures, the crop was 67 per cent. larger, and contained 56 lbs. more nitrogen per acre than the unmanured, the increase in nitrogen being in large measure due to the leguminous plants which came in under the influence of the potash, and replaced plants of other families.

“In one case Messrs. Lawes and Gilbert found that a soil from which a clover crop had just been removed contained more nitrogen than it did before the clover was put in; that, in other words, the soil, to the depth of nine inches at least, was positively enriched by the growth and removal of a highly nitrogenous (clover) crop.

“Such facts help to explain why it is such good farm practice to use mineral fer-

tilizers, as plaster, bone, ashes and potash salts, for mixed grasses and clover; and nitrogenous materials, like guano, sulphate of ammonia and nitrate of soda for grain crops. They help us to understand why clover is such an excellent preparatory crop for wheat, and so economical generally for plowing under to bring up poor soils. It gathers and stores plant-food, particularly nitrogen, and thus is itself a fertilizer.

"In Messrs. Lawes and Gilbert's experiments, the cereals have been most helped by nitrogen, next by phosphates, and very little by potash; the legumes have responded to mineral manures, especially potash, and paid little heed to nitrogen except where on meadow land they have, under the influence of nitrogenous manuring, gradually run out, and the grasses have taken their place, just as they have replaced the grasses when mineral manures alone were used; turnips have done best with superphosphates; and potatoes, I think, have seemed to demand potash along with nitrogen and phosphates for their best development.

"Doubtless the most important phase of this question is the relation of plants to the nitrogen supply, as is illustrated by the much-vexed question as to the power of the maize plant to gather its nitrogen from natural sources.

"Mr. Lawes has written a letter to the Secretary of the New Jersey Board of Agriculture, and also another letter to Mr. Harris, discussing this same question, and insisting, as Mr. Harris also does, upon the need of experiments to test it. He says, 'It is of very great importance to know to what extent Indian Corn follows the same law [as the cereals]; that is to say, on a soil which, under a liberal supply of potash and phosphoric acid, will yield 20, 30 or 40 bushels of corn, what increase is obtained by a liberal supply of ammonia or nitrates?'

"In his excellent little book, 'Talks on Manures,' Mr. Harris says: 'We know less about the manurial requirements of Indian Corn than almost any other crop we cultivate.' The main question is the nitrogen supply—whether like other cereals (wheat, barley, oats, grasses, etc.), corn has but little power to get nitrogen from natural sources, and requires nitrogenous fertilizers; or, whether, like leguminous plants (clover, beans, peas, etc.), corn can gather the nitrogen for itself; that is, whether corn is, like wheat, an exhausting crop, or, like clover, a renovating crop. Mr. Harris is rather inclined to class it with the cereals, but mentions some facts which indicate that in feeding capacity it is more like the leguminous plants. If the latter is the case, then India corn grown and consumed on the farm will, 'like clover, enrich the land—the corn will gather up the nitrogen that the wheat crop cannot appropriate, and when the corn and stalks are fed, some 90 per cent. of the nitrogen will be left in the manure.'

"In a very interesting letter to Mr. Harris, Mr. Lawes discusses this question at length. He is inclined to class corn with the cereals, though he would expect that with mineral fertilizers it would, during its longer period of growth, get more food from soil and air, and especially more nitrogen, and give a larger produce than wheat. At the same time he adds: If wheat and maize were grown continuously for experiment, I should expect that maize, if manured with manure such as wood ashes and superphosphate, would give a larger produce than wheat. But to produce full crops both would require, in addition, large quantities of nitrogen to be supplied as ammonia or nitric acid.

"In illustration of the application of these theories and results of experiments, I may cite several

FORMULAS FOR FERTILIZERS FOR CORN.

"In a letter to the Treasurer of the Massachusetts Society for Promoting Agriculture, Mr. Lawes says: 'The best possible manure for all the graminaceous crops—wheat, barley, maize, oats, sugar-cane, rice, pasture grass—is a mixture of superphosphate of lime and nitrate of soda.'

"M. Ville urges what he calls 'complete fertilizers,' containing nitrogen, phosphoric acid, potash and sulphate of lime, and regulates the proportions by the assumed power of the plant to get its food from soil and air, and the special effects of the different fertilizing substances upon it. Classing corn with sugar-cane, sorghum, turnips, rutabagas, and artichokes, he makes phosphoric acid the 'dominant,' or most efficient ingredient. Below is his formula for an acre of corn, with the amounts of valuable ingredients and their cost in the forms he recommends. The last column gives the cost in equally good but cheaper materials, like nitrate of soda, guano, bone and potash salts, which, with many important facts in agricultural chemistry, his system curiously ignores.

"Prof. Stockbridge, of the Massachusetts Agricultural College, announced some time since a series of fertilizers for different crops based upon the percentages of nitrogen, phosphoric acid and potash which the crops are found, by analysis, to contain. Thus he recommends for Indian corn: 'To produce 50 bushels of the grain, and its natural proportion of stover to the acre, more than the natural yield of the soil; and in like proportions for other quantities, use'—the formula below. To the formula I append cost of materials as recommended by Prof. Stockbridge, and the cost of same ingredients in cheaper forms, basing estimates here, as elsewhere, upon current market rates, with \$5 per ton added for freight and handling. To resume, we have

MR. LAWES' FORMULA.

"'The best possible manure,' a 'mixture of nitrate of soda and superphosphate.'

VILLE FORMULA FOR ONE ACRE.

Materials.	Ingredients.	Cost in formula.	In cheapest form.
Nitrate of potash, 180 lbs.,	Nitrogen, 24 lbs..... Phos. acid, 81 lbs..... Potash, 79 lbs.....	\$9 20	\$4 80
Acid phosphate of lime, 550 lbs.....		9 45	9 45
Sulphate of lime, 360 lbs.....		7 00	3 56
		1 44	1 44
		<u>\$27 09</u>	<u>\$19 25</u>

STOCKBRIDGE FORMULA FOR ONE ACRE.

Materials.	Ingredients.	Cost in formula.	In cheapest form.
Sulphate of ammonia, 320 lbs.	Nitrogen, 64 lbs.....	\$15 20	\$12 80
Superphosphate, 248 lbs.	Phos. acid, 31 lbs.....	4 34	4 34
Muriate of potash, 154 lbs.	Potash, 77 lbs.....	3 46	3 46
		<u>\$23 00</u>	<u>\$20 60</u>

"Mr. Lawes omits and Profs. Stockbridge and Ville supply potash in their formulas. All include nitrogen, Mr. Lawes specifying no quantity, Mr. Ville using but little, and Prof. Stockbridge a very large amount. Ville lays chief stress on phosphoric acid, which he calls the 'dominant' for corn, while the Stockbridge formula gives very little of phosphoric acid, and makes nitrogen the most important ingredient.

"It is thus evident that men who ought to be well fitted to judge differ very widely in their views upon these most important subjects, and that nothing but *actual experiment* will bring us the certain knowledge that is needed."

No doubt the experiments of Messrs. Lawes and Gilbert are the most exact, practical and valuable which have been made in the use of fertilizers. Some of them I have detailed and commented on in a former Report.

Prof. Atwater, in his valuable Report of "Field Experiments with Fertilizers, 1880," from which we have just quoted, enters at length on

THE RELATION OF THE MAIZE PLANT TO THE NITROGEN SUPPLY.

The question is first discussed as to the power of Corn to get its nitrogen from the atmosphere, like leguminous plants, or whether it follows the law of other cereals and requires it to be artificially supplied. The general belief and observation is that it cannot get much from the atmosphere, else why do poor lands always produce poor crops of corn? Another point discussed is, what is the "dominant" fertilizer for corn. Ville says it is Phosphoric Acid, and some experiments carefully conducted by Mr. Bartholomew, quoted by Prof. Atwater, seem to bear out this view. This, however, is again contrary to general belief, for we have been taught to believe that Nitrogen was the most important for corn, as borne out by the use of stable manure, but we must remember that stable manure contains a good percentage of Phosphoric Acid. We will quote presently from the results arrived at by Mr. Bartholomew and others, favoring the Phosphoric Acid as being "dominant" for corn, and also from another experimenter, Mr. Newton, who arrived at a different conclusion—one in favor of Nitrogen. Very probably the difference of soils and their constituents accounted for the different results, though Prof. Atwater says he cannot tell "why this was so."

Prof. Atwater with great assiduity has collected and collated the results of many experiments, about 250, extending through 1878-79-80, viz., "Special Experiments upon the Effects of Nitrogenous Fertilizers," accompanied with numerous tables. To properly comprehend these experiments and all the results would require much care and study. We must content ourselves, and at the same time avoid wearying our readers, by giving some of the results:

EFFECTS OF NITROGENOUS FERTILIZERS UPON CORN.

"Estimating a bushel of corn, with its cobs and stalks, to contain $1\frac{1}{2}$ pound of nitrogen, and to be worth 80 cents, the effects of the nitrogenous fertilizers in the special and in the general experiments may be summarized as follows, remembering that the superphosphate and potash salt, 'mixed minerals,' supplied the amounts of phosphoric acid and potash in a crop of not far from 55 or 60 bushels, which would also contain about the 72 pounds of nitrogen:

AVERAGE RESULTS OF EXPERIMENTS WITH CORN IN 1878, 1879, 1880.

Bushels of Corn and Pounds of Nitrogen in Crop per Acre.

	<i>Corn, bushels.</i>	<i>Nitrogen, pounds.</i>
<i>11 Special Experiments.</i>		
'Mixed minerals' alone.....	45.2	60.4
Samex24 lbs. nitrogen.....	54.5	72.7
Same 48 lbs. nitrogen.....	55.4	73.8
Same 72 lbs. nitrogen.....	56.7	75.6
<i>75 General Experiments.</i>		
'Mixed minerals' alone.....	43.4	57.8
Samex24 lbs. nitrogen.....	47.8	63.7

"In the general experiments the mixture of 300 pounds superphosphate and 200 pounds muriate of potash brought, on the average of fifty-three experiments, about 43½ bushels of shelled corn per acre. The special experiments, however, seem to me a fairer test of what the fertilizers may do, because, while made in all sorts of weather and on worn-out soils, they were nearly all on soils and in latitudes fit for corn, as many of the general experiments were not. In these, the mixture of 300 pounds superphosphate and 150 pounds of potash salt, which can be bought for \$8.25, brought on the average 45 bushels of shelled corn per acre.

"The experiments of these seasons bear unanimous testimony to two things: The corn was helped but little by nitrogen in the fertilizers; and it gathered a good deal from natural sources. The increase of crop and of nitrogen in the crop will appear more clearly if we look at it another way."

Omitting table which follows, we quote:

"The nitrogen increased the crop enough to pay its cost in thirty trials out of one hundred and fifty. The pecuniary loss rose and fell with the amount of nitrogen used. With mineral fertilizers alone the crop gathered, by the above estimates, some 60 pounds of nitrogen per acre.

"A REMARKABLE EXCEPTION"

to the rule that the corn is able to gather a fair supply of nitrogen for itself, and is not much helped by nitrogenous fertilizers, occurs in the experiment of Mr. Newton, 'K, 1880.' Here, every plot without nitrogen was a failure, every one with it gave a large yield, and the produce rose and fell regularly with the amount of nitrogen applied.

"Why this was so, I surely cannot tell. A natural explanation—that the soil lacked nitrogen, because it had been lately cropped with oats and rye, and had not the mass of grass roots to supply nitrogen that the old grass lands of many of the other experiments—is not supported by the testimony at hand. In Colonel Mead's experiment, 'F, 1879,' the corn followed oats, and yet no good from the nitrogen. In several cases in which the experiments have been repeated, corn following corn, with the same fertilizers, upon the same plots, as in Mr. Bartholo-

mew's, 'C, 1879,' and '1880,' the nitrogen was as ineffective the second year as the first. So, likewise, in a similar experiment by Mr. J. W. Sanborn, Farm Superintendent of the New Hampshire Agricultural College, the yield of corn in 1878 was increased, in 1879 diminished, and in 1880 materially injured by nitrogen as sulphate of ammonia. Mr. Sanborn's corn, like that of the other experimenters who have been repeating their trials, has been as persistent in doing well with mineral fertilizers alone, and getting its own nitrogen, as it has in refusing to respond to nitrogen in fertilizers.

WHERE AND HOW DOES CORN GET ITS NITROGEN?

"This is a question I cannot answer. The prevailing opinion among agricultural chemists for some time, and one which I have shared, has been that plants get nearly all their nitrogen from the soil and very little from the air. But there are many facts which are very hard to explain on this theory, and I am, with many others, coming to suspect very strongly that plants do, somehow or other, get considerable nitrogen from the air. It may not be out of place to add that one of the public-spirited agriculturists of our State, Hon. J. W. Alsop, M. D., of Middletown, has undertaken to furnish appliances and to defray the expenses of some series of experiments in his greenhouse and our laboratory, with a view of obtaining some more light on this important question.

THE 'DOMINANT' FERTILIZING INGREDIENTS.

"It will be interesting to note in how far the theory of 'dominant ingredients' is borne out by the experiments. According to Ville, the 'dominant' for corn is phosphoric acid. The effects of the superphosphate, potash salt, and nitrate of soda, in the experiments may be stated as follows:

"By reference to Table IV, it will be seen that in ten experiments, Nos. 1, 2, 4, 8, 9, 10, 13, 14, 15, and 20, phosphoric acid was decidedly the regulating ingredient, the crop responding uniformly to it, and paying comparatively little attention to the others. In six experiments, Nos. 6, 11, 12, 16, 18, and 19, the superphosphate, though not holding relatively so important a place, was more or less useful. In four experiments, Nos. 3, 5, 7, and 17, the superphosphate produced little or no effect, the average increase of the several plots of each experiment being less than 4 bushels per acre. The effects of the superphosphate, muriate of potash, and nitrate of soda, estimated in the above manner, may be stated as in the table below, which includes results of experiments of previous seasons."

Omitting table, we give the following results:

"Phosphoric acid took the leading place often, potash occasionally, and nitrogen very rarely. In bad seasons, and on some soils in good seasons, neither material had any effect. The most effective ingredient depended upon soil and season."

We now come to the question—

IS CORN IN ITS RELATIONS TO NITROGEN MORE CLOSELY ALLIED TO THE CEREALS OR THE LEGUMES?

“In relation to this question, I can do no better than repeat what was said in last year’s report :

“Our experiments imply that corn shares, to a considerable extent, the power of the legumes for gathering nitrogen from natural sources. One thing, however, detracts from their decisiveness. Most of the trials were on old grass land which contained large quantities of roots on which the corn doubtless fed. How well it could provide itself with nitrogen from nitrogen compounds in the soil and from air without the roots to feed upon is not settled.

“The experiments are numerous and decisive enough to warrant the inference that, as corn is commonly grown, nitrogenous fertilizers in any considerable quantity would be rarely profitable. They imply that corn has somehow or other the power to gather a great deal of nitrogen from soil or air, or both, they imply that in this respect it comes closer to the legumes than the cereals—that, in short, corn may be classed with the renovating crops.’”

Next we have—

THE FEEDING CAPACITIES OF POTATOES, TURNIPS, AND OTHER CROPS.

“Our experiments throw some light upon this question, as may be seen from Tables I and IV, and from a comparative summary of average results of all the experiments in Table VI.

“Thus, in the experiments of Mr. Bartholomew, No. ‘C. 1879,’ and ‘1880,’ of Table I, in which corn and potatoes were grown side by side, the corn has responded uniformly and largely to the superphosphate, and paid little heed to the other materials, while the potatoes have responded to all. Other experiments on adjacent fields have brought like results. The same thing is observable in the averages of Tables IV and VI. In brief, another season’s experiments confirm the statement in last year’s report, that—

“‘Taking all in all, the potatoes responded to the superphosphate, potash salt, and nitrogenous fertilizers in almost every case where the weather permitted fair growth. None of the other crops except, perhaps, turnips have shown such uniformly beneficial results from all the materials.

“‘The experiments indicate very decidedly that the potato plant differs from many others in respect to the effect of these fertilizing materials upon its growth, and imply that it has less capacity than corn for gathering an adequate supply of food from natural sources. It seems to demand a full and immediately available supply of nourishment for its successful growth.

“‘Concerning the other crops, the data at hand are too meagre to warrant any general conclusions. . . . In general, however, the experiments accord with the common notion that makes superphosphate almost a specific for turnips. But they imply that even when the superphosphate is supplied in abundance, the turnip is not usually able to gather enough of the other materials for a full yield unless they are close at hand in readily available forms.’”

We now give the results of Mr. Bartholomew's experiments :

"MR. BARTHOLOMEW'S EXPERIMENTS,

which have now continued for four years, covered nearly one hundred plots, been repeated on the same plots, with the same fertilizers and the same crop, year after year, and on other parts of the same field, and on contiguous fields and with other crops, are decidedly the most instructive and valuable ever made, to my knowledge, by a private individual in this country. Some, with corn and potatoes, have been reported in Table III. I wish here to call especial attention to another experiment with corn, commenced in 1877, and continued until the present. The plots were 10 square rods each. The fertilizing materials have been :

No. of Plot.	FERTILIZERS.			
	KIND.	Lbs. per acre.	At price per ton.	Cost per acre.
1	Dried blood.....	320	\$40 00	\$ 6 40
2	Dissolved bone-black.....	320	35 00	5 60
3	Muriate of potash.....	320	45 00	7 20
4	{ Dried blood.....	160	37 00	6 00
	{ Dissolved bone-black.....	160		
5	{ Dried blood.....	106½	40 00	6 40
	{ Dissolved bone-black.....	106½		
	{ Muriate of potash.....	106½		
6	Plaster.....	320	10 00	1 60

"Wood ashes, dry and leached, and farm manures, were likewise employed, as indicated below. A number of brands of manufactured fertilizers were also tried, with results according with those from the regular experimental fertilizers.

"In Mr. Bartholomew's experiment above, while the yields have naturally varied with the seasons, the proportions on the different plots from year to year have remained strikingly constant. As in the first season, so in the others to the fourth, the crop has risen and fallen with the phosphoric acid, and paid very little attention to the other ingredients. Indeed, the following statement from the reports of the experiments in 1877 are, with unimportant exceptions, equally appropriate to those of 1880.

"(1) In the four cases, Nos. 1, 3, 6 and 0, where phosphoric acid was not supplied, the crop failed. (2) In every case where phosphoric acid was supplied either alone (i. e., as superphosphate with the lime and sulphuric acid incident thereto), or with other materials in Nos. 2, 4, 5, 8, 9 and 10, the crop was good. (3) The amounts of phosphoric acid per acre in Nos. 2, 4 and 5 were 51, 25½ and 17 lbs., respectively; the yields, 41.6, 38, and 33.5 bushels, showing a corresponding decrease. Comparisons of the amount of phosphoric acid applied and corn produced in the other cases, of which limited space excludes details, show a similar and singularly uniform ratio between the two. This parallelism between phosphoric acid and yield runs through the plots with ashes, which contain less of the phosphoric acid, and brought less corn; and those with farm manures, which contain more,

and brought more. (4) The produce with potash-salt, and with dried blood alone, was less than on the one plot with no manure. (5) While the crop responded uniformly to the phosphoric acid, it got little apparent benefit from the other ingredients of either the chemical fertilizers, the ashes, or the farm manure.'

"And in all of the scores of trials which Mr. Bartholomew has made in amplification of these experiments, the same results have been obtained; corn has responded largely to phosphoric acid, less to nitrogen, and scarcely at all to potash. I cannot forbear repeating that Mr. Bartholomew has uniformly got the best results by using a moderate dressing of farm manures, supplemented by superphosphates. Indeed, in his case, as in many others, the proper use of commercial fertilizers is to supplement the farm manures. But it should be remembered, that while nitrogen and the potash have produced so little effect on corn, on potatoes they have been as uniformly useful and profitable.

"It would hardly be permissible to omit reference to the information the experiments give us as to what commercial fertilizers farmers may advantageously use. Indeed, it was for this purpose the experiments were at first proposed. The principle, as expressed in previous reports, is briefly this:

"The chief office of fertilizers is to supply the plant-food that our crops need and soils fail to furnish. It is not good economy to pay high prices for materials which the soil may be made to yield in abundance, or which may be supplied by the carefully-husbanded manures of the farm, but it is good economy to supply the lacking ones in the cheapest way. The most important ingredients of our common commercial fertilizers are *Phosphoric Acid*, *Nitrogen* and *Potash*, because of both their scarcity in the soil and their high cost. It is in furnishing these that Guano, Phosphates, Bone Manures, Potash Salts, and most other commercial fertilizers, are chiefly useful. Accordingly, the three ingredients named were to be supplied (see TABLES II and III), each by itself, two by two, and all three together.'

SOILS ESPECIALLY BENEFITTED BY PHOSPHORIC ACID.

"In Mr. Bartholomew's corn experiment, No. 10, every plot in which phosphoric acid was applied brought a good crop, and every one without it failed. The nitrogen and potash both increased the yield, but, reckoning a bushel of corn with its stalks at 80 cents, neither increased it enough to pay the cost.

"In Mr. Clendon's experiment, No. 1, and Mr. Wolcott's, No. 8, the results with phosphoric acid are equally striking. There are, however, many

SOILS WHICH RESPOND WELL TO POTASH-SALTS.

"This is the case with Mr. Hick's experiment with corn, No. 17, and in nearly all the trials with potatoes. I do not find so many striking instances of great success with potash-salts, and failure without them in the experiments of this as previous seasons.

GENERAL CONCLUSIONS.

"The following conclusions summarize the main results of the General and Special experiments as applied to the practical use of fertilizers. That they are similar to the conclusions in previous reports is due to the simple fact that the experiments of the different seasons tell essentially the same story:

"1. As the experiments were mostly on worn-out soils, the average produce with a given crop does not represent what might be expected under fair conditions.

"2. The largest yield came with the "complete" Chemical Fertilizer (*G*), which supplies 150 lbs. of nitrate of soda, 300 lbs. of superphosphate, and 150 to 200 lbs. of muriate of potash, at a cost of a little over \$15 per acre.

"No. *G* has brought by far the best results. It was generally the most profitable of all with potatoes, and often so with corn and other crops. This mixture has not only brought larger yields than the farm manures, but has also proved more certain, in favorable seasons, and in cold, wet and drouth. I would not propose just these proportions for general use, however. Less potash and more nitrogen would generally be better for some crops, as grain, potatoes and garden vegetables. The object here was to test soils, and not to get the largest possible yields.

"3. The next largest average yield is with the farm manures. Then follows the mixture of superphosphate and muriate of potash (*F*). This latter averaged most profitable of all for corn.

"4. Next came the mixture of nitrate of soda and superphosphate (*E*). That this, which contained superphosphate and nitrate of soda, should bring a lower average yield than the mixture of superphosphate and potash-salt with every crop on which the number of trials is large enough to warrant any general conclusions, is certainly a significant fact. Our ordinary guanos, ammoniated superphosphates and fish manures, contain (like *E*) nitrogen and phosphoric acid, with a little or no potash. Nitrogen is the costliest, and potash one of the cheaper of the valuable ingredients of ordinary fertilizers. Another season's experience thus emphasizes last year's statement, that manufacturers and users of ammoniated superphosphate would do well to consider the propriety of either adding potash-salts or substituting them for nitrogenous materials in their fertilizers. Indeed, I see many are doing so.

"5. These experiments explain very clearly one reason why guano, fish, bone, superphosphates, etc., so often fail. In many cases the trouble is lack of potash.

THE BEST FERTILIZERS FOR DIFFERENT CROPS.

"6. To prescribe formulas to fit all cases is utterly impossible. The needs and the effects of the different materials, in any case, are decided by numerous factors, of which the most important are soil, season, tillage, feeding capacity of the crop, and indirect action of the fertilizers. The character of the season cannot be foretold. The wants of the soil can be learned practically by experiment alone. Of the feeding capacities of different crops much is already known, and experiments like these are telling us much more. As to the indirect action of fertilizers in improving the texture of the soil, and setting plant food free, science has taught us a great deal, but more research will be needed before we shall be able to lay down general rules with certainty.

FORMULAS FOR FERTILIZERS.

"7. I am continually receiving requests for formulas for fertilizers for different crops. Several such letters, just received, are before me. I find myself answering, generally, somewhat as follows: 'The first and most important thing to be

found out is what your soil lacks. That I cannot tell you. It may be phosphoric acid or potash; perhaps plaster or lime may serve your purpose, and possibly the trouble may be one that fertilizers will not help, at least not until the soil is drained, irrigated, or better tilled. The best advice I can give is to experiment on a small scale; find what materials are most effective and profitable, and then use them. But if you cannot or will not do this, you can use guano, phosphate, or bone, or potash-salt, and take the risk of its fitting your case; or use a complete fertilizer that contains all the materials that soils generally lack. In the latter case you risk paying for some ingredients that will give no adequate return.' But at the same time, it should be said that the general outcome of the experiments is much more favorable for 'complete' fertilizers than I anticipated.

"As to special formulas for different crops, I make no prescriptions. The intelligent dealers who do so know very well that it is for their interest to make their mixtures such as will, on the average, bring the largest practicable profit to the consumer, and are very careful to get the best results of research and experience and use them in preparing their materials. Some I know to be among our most enthusiastic and successful students of these subjects. I can suggest no better formulas than many of those in actual use by trustworthy dealers.

"8. Leaving variations in soil and season out of account, and considering the feeding capacity of the crops, as shown by these and other experiments, and by general experience, it is safe to say that—

"(1) For *corn*, an excellent fertilizer to bring large crops is a mixture of Peruvian guano, or fish guano, and muriate of potash. To this it might be profitable to add some fine ground bone or superphosphate. In the majority of cases, though not always, a more profitable mixture would probably be one of muriate of potash, with either superphosphate or fine ground bone, or both. At the same time there are cases in which nitrogen helps the crop enough to make it profitable, and in which nitrate of soda, sulphate of ammonia, dried blood, guano, or fish, would be in place.

"(2) For *potatoes*, which respond more generally than corn to both nitrogen and potash, such of the above mixtures as contain considerable nitrogen would generally be in order.

AS TO COMMERCIAL FERTILIZERS IN GENERAL.

"9. For general farming, at a distance from the large markets, the chief use of commercial fertilizers should be to supplement the manure of the farm. The right way is to make the most and best manure that is practicable upon the farm, and piece out with such commercial fertilizers as experiments and experience prove profitable. At the same time there are many cases, especially near cities, where everything depends upon getting the largest and best yield, and where more exclusive use of chemical fertilizers is advisable.

"10. Either the combined testimony of these experiments, similar ones elsewhere, and the best experience are totally false, or chemical fertilizers bring larger, better, and even surer crops than farm manures.

IN CONCLUSION.

"Taken all together, the experiments emphasize more and more strongly, year after year, the conclusions expressed in previous reports, that—

"11. Soils vary widely in their capacities for supplying crops with food, and consequently in their demand for fertilizers.

"12. Some soils will give good returns for manuring; others, without previous amendment, by draining, irrigation, tillage or use of lime, marl, etc., will not.

"13. Farmers cannot afford to use commercial fertilizers at random, and it is time they understood the reason why.

"14. The right materials in the right places bring large profits. Artificial fertilizers, rightly used, must prove among the most potent means for the restoration of our agriculture.

"15. The only way to find what a soil wants is to study it by careful observation and experiments."

These results are valuable, though there are some things which it would be desirable to have more definitely settled; and Mr. Newton's experiment, noticed above, does not tally with the conclusions aimed at by others. These differences may possibly be accounted for by differences of soils and their contents. In Mr. Newton's land there must have been great deficiency of nitrogen. The opinion entertained by some persons at the present day, and earnestly contended for, that nitrogen is not necessary for any soils, seems singular. Some manufacturers of fertilizers hold to this opinion, and manufacture their brands without nitrogen, contending that it is not necessary.

Prof. Atwater gives the plan for experiments which he sent out to be used by persons, the result of whose tests he published in his report referred to. Perhaps it will be well to give the plan for the guidance of those who may wish to experiment with these articles on their soils. It is the most certain manner of finding out what fertilizers suit particular soils, and what they are deficient in. He says: "The main points are to (1) Select level or nearly level and uniform land. (2) Lay out the plots accurately (see figures for calculating dimensions in 'Condensed Directions'). (3) Distribute the fertilizers evenly over the plots. (4) Conduct the experiment carefully, and (5) Make an accurate report, for which blanks will be sent in due season.

"Please indicate the boundaries of the plot, by *strong* stakes, and, if convenient, arrange to repeat the experiments with the same fertilizers on the same plots through a series of years and crops.

SIZE OF EXPERIMENTAL FIELD—"ONE ACRE" AND "TWO ACRE" EXPERIMENTS.

"Experience implies that, under ordinary circumstances, plots of one-twentieth acre each, making one acre for the twenty plots, will suffice. Where convenient, however, it would be well to use two acres. This has been done to advantage when two crops, as corn and potatoes, have been grown side by side on each plot for comparison, an excellent plan for testing the comparative feeding capacities of the plants.

"If practicable, leave an unmanured strip, say three feet wide, between each two plots, to prevent the roots of each from feeding on fertilizers of the next. This will increase the whole area, but will make the experiment much more valuable.

KIND OF CROP.

"The kind of crop will, of course, be selected by the experimenter. Experiments are needed upon all our ordinary crops, but especially on wheat, barley, rye, oats, corn, sorghum, grass, clover, onions, potatoes, roots, and in the South, sugar cane and cotton.

EXPERIMENTAL FERTILIZERS—SPECIAL NITROGEN SET, 1881.

Cost of "Acre Set," \$12—"Two Acre Set," \$22.

No.	MATERIALS.	AMOUNTS.	
		Acre Set. For 120th acre plots.	Two Acre Set. For 1-10th acre plots.
1.	Nitrate of soda.....	7½ lbs.	15 lbs.
2.	Superphosphate.....	15 "	30 "
3.	Muriate of potash.....	7½ "	15 "
4.	{ Nitrate of soda.....	7½ "	15 "
	{ Superphosphate.....	15 "	30 "
5.	{ Nitrate of soda.....	7½ "	15 "
	{ Muriate of potash.....	7½ "	15 "
6.	{ Superphosphate, } Mixed.....	15 "	30 "
	{ Muriate of potash, } minerals.....	7½ "	15 "
7.	{ Mixed minerals, as No. 6.....	22½ "	45 "
	{ Nitrate of soda.....	7½ "	15 "
8.	{ Mixed minerals, as No. 6.....	22½ "	45 "
	{ Nitrate of soda.....	15 "	30 "
9.	{ Mixed minerals, as No. 6.....	22½ "	45 "
	{ Nitrate of soda.....	22½ "	45 "
10.	{ Mixed minerals, as No. 6.....	22½ "	45 "
	{ Sulphate of ammonia.....	5½ "	11½ "
11.	{ Mixed minerals, as No. 6.....	22½ "	45 "
	{ Sulphate of ammonia.....	11½ "	22½ "
12.	{ Mixed minerals, as No. 6.....	22½ "	45 "
	{ Sulphate of ammonia.....	16½ "	33½ "
13.	{ Mixed minerals, as No. 6.....	22½ "	45 "
	{ Dried blood.....	11½ "	22½ "
14.	{ Mixed minerals, as No. 6.....	22½ "	45 "
	{ Dried blood.....	22½ "	45 "
15.	{ Mixed minerals, as No. 6.....	22½ "	46 "
	{ Dried blood.....	33½ "	67½ "
6a.	{ Superphosphate, } Mixed.....	15 "	30 "
	{ Muriate of potash, } minerals.....	7½ "	15 "
6b.	{ Superphosphate, } Mixed.....	15 "	30 "
	{ Muriate of potash, } minerals.....	7½ "	15 "
6c.	{ Superphosphate, } Mixed.....	15 "	30 "
	{ Muriate of potash, } minerals.....	7½ "	15 "

Nos. 6a, 6b and 6c are simply duplicates of Mixed minerals No. 6.

SPECIFICATIONS.

"Materials to be weighed and mixed with greatest possible care and accuracy, put in eighteen bags numbered as above, and each bag furnished with a label stating number and contents per schedule above. *Minimum* percentages as below.

"Nitrate of soda to contain 16 per cent. nitrogen; sulphate of ammonia 21 per cent. nitrogen; dried blood, 11 per cent. nitrogen.

"Superphosphate (dissolved bone black) to contain 15 per cent. of soluble, and 16 per cent. total phosphoric acid.

"Muriate of potash to contain 50 per cent. of potash.

"No. 6, the mixture of Superphosphate and Muriate of Potash, is designated as 'Mixed minerals.' This is duplicated in Nos. 6a, 6b, and 6c. The same mixture forms the basis of Nos. 7 to 15 inclusive, which consist of 'Mixed minerals,' with the addition of nitrogen compounds.

"The fertilizers were supplied, in part at cost, and in part gratuitously, by the *Mapes Formula and Peruvian Guano Co.*, to whose interest and enthusiasm in promoting the experiments especial thanks are due.

"Each set of experimental fertilizers was accompanied by directions for use (see above) and a blank on which the experimenters were requested to record their observations and the results obtained.

"The blanks were sheets of paper 12 x 19 inches in size, with spaces for numerous details as to soil, weather, culture, and produce.

SPECIFIC EFFECTS OF THE DIFFERENT FERTILIZING MATERIALS.

"To make these plainer, Mr. Beamer has prepared what we have got into the way of calling a 'Table of Differences,' Table IV, Appendix B, which shows very clearly the effect of each material—nitrate of soda, superphosphate, and muriate of potash—both when used alone and when mixed with others. The effect of nitrate of soda alone is calculated by subtracting the average yield with no manure from that of the nitrate of soda plot. To find its effect with superphosphate, the yield of the phosphoric acid plot is subtracted from that which had the mixture of the two. The increase with the complete fertilizer over that with the superphosphate and potash salt gives the effect of the nitrate of soda again, and so on. Of course it is understood that these differences in a given case do not express exactly the effect of the nitrogen, phosphoric acid, or potash, nor even that of the fertilizer containing them. The indirect action of the fertilizer counts for something, and the irregularities in the different plots often a good deal more. Indeed, one of the most interesting uses of this table is to show the uniformity, or lack of uniformity, of the action of the materials on the different plots, and hence the reliability of the experiment. In experiment No. 4, for instance, the plot with nitrate of soda shows 1.4 bushels less corn per acre than that with nothing, while the increase with nitrate of soda on the other plots over the corresponding plots without it, is little or nothing. But when we come to the superphosphate we find an increase of from 11½ to 18 bushels in every case. The potash, on the other hand, brings either a small increase or a decrease on every plot. The results here are very uniform. But in other experiments as No. 26, the figures are very far from uniform. This test of the uniformity of an experiment is a severe one. Any irregularity in the soil or other circumstance that changes the yield of one plot from what it should be is brought into full relief, and even exaggerated by these subtractions, and is further multiplied by ten or twenty, or even more in calculating from small plots to yield per acre.

"This table of differences seems to me well worthy of study. I find myself referring to it always, and generally to it alone, when I wish to find whether an experiment is uniform and reliable, and what are the effects of the different fertilizing materials."

These experiments, instituted by Prof. Atwater, of the Experimental Station, Wesleyan University, Middletown, Conn., show the importance attached to the great interest of agriculture by this State, and should serve as an incentive to our State, so admirably adapted by nature to agriculture, to establish a similar institution. Virginia is lagging behind. Even our Rip Van Winkle neighbor (North Carolina) has aroused from her sleep, and is outstripping us in the promotion of the great interest, which supports all other interests, by the establishment of an Experimental Station, and by a liberal support of her Agricultural Department. Our General Government, by a vote taken in Congress some two winters since, refused to establish an experimental farm near Washington as requested by our Commissioner of Agriculture, while very large amounts are being unnecessarily expended for the extravagant support of other Departments, with their myriads of clerks and employes.

Had I the means, I would be glad to distribute to farmers fertilizers for experiment, and I think the State would do well to give me the means to do so. When the Department was established, in 1877, I required of the manufacturers a certain amount of their fertilizers to test on the soil. The manufacturers outside the State willingly responded to this requirement, and it will be remembered that in 1878 I had a considerable number of soil tests, made by farmers in various sections of the State, and published the results. One of the home companies refused to furnish a sample of their brand, and the consequence was, the disputed point had to be referred to our State Attorney General for arbitration. He decided that the law establishing the Department did not authorize me to make this requisition, though the Attorney General for Georgia had decided that the law for that Department, of which ours was a copy, did authorize such action on the part of the Commissioner of Agriculture of that State, who has annually been carrying out such soil tests. To obviate the difficulty in our State, the only alternative now is for the farmers to make such tests for themselves on their lands, at their own expense, a procedure which, we think, will well repay them. This question of the proper and profitable use of fertilizers and their adaptation to particular soils is a difficult one, and the farmers must study it, must experiment with different brands, and the different constituents used as fertilizers, obtaining all the light they can in every available manner.

Prof. Atwater, though a chemist, in the *American Agriculturist*, very candidly says: "In fact, in the very defective condition of our knowledge of these subjects, the surest and best way to learn what are the needs of a given soil is by actual experiment with different fertilizers and crops, and modes of treatment." And as pertinent to this subject we give the following, which is found on the title page of Prof. Atwater's report:

"These experiments, it is true, are not easy; still they are within the power of every thinking husbandman. He who accomplishes but one, of however limited application, and takes care to report it faithfully, advances the science, and, consequently, the practice of agriculture, and acquires thereby a right to the gratitude of his fellows, and of those who come after. To make many such is beyond the power of most individuals, and cannot, therefore, be expected. The first care of all societies formed for the improvement of our science, should be to prepare the forms of such experiments, and to distribute the execution of these among their members."—ALBRECHT THAER, *Principles of Rational Agriculture*.

WILL COMMERCIAL FERTILIZERS PAY?

This question has been briefly discussed in my former reports. We have there expressed the opinion that if commercial fertilizers are properly and judiciously used, they would pay. Because they fall in the hands of poor farmers, and in dry seasons, and in consequence of badly and dishonestly made fertilizers, is no proof they will not succeed under opposite circumstances, as they usually will. The class of persons who succeed with these fertilizers and believe in them, is an argument in their favor. The most thriving farmers use fertilizers; there are more used in the Valley than in any other portion of the State, and we know what successful farmers inhabit this portion of Virginia. Formerly they were much applied in the Southside counties of the State on tobacco, until the great depression in the price of this article made it unprofitable, and in some case impossible to buy them. Their use is again gradually extending, as the prices of tobacco is gradually improving. In North Carolina scarcely any planter who raises tobacco attempts to do so without these fertilizers, and with prices for their "Fancy Brights" ranging from \$25 to sometimes more than \$200 per hundred, they can well afford to use them, and they think they cannot do without them. In Georgia, their application on cotton is extensive, amounting annually to near a hundred thousand tons, while in Virginia it is thought we did not use more than thirty-five or forty thousand tons, and probably not as much as the first amount during the late years of financial trouble and depression of prices of crops. In other Southern cotton States, they are much used, and in England their application to lands, among the best farmers, is very extensive. Unless fertilizers, properly used, pay, the best and most calculating farmers would not expend their money on them. These best and most intelligent farmers have learned how to select and how to apply them, and on what crops they are most profitable. On the wheat crop of Virginia, taking into consideration the whole State, they, we think, have not paid. Much land in Eastern Virginia is seeded to wheat which is not suited to that crop, and on such lands commercial fertilizers will not pay. On good wheat lands, where, as a general rule, this crop pays, fertilizers will usually add enough to the crop to secure a profit. On light lands a good wheat crop is the exception, and on such lands the amount paid for artificial manures is often a total loss, unless a "catch" of grass is secured, and then the loss may be made up. It is well known that much of our lands in Tidewater and Middle Virginia will not "take" in clover or the grasses without some artificial aid; and if on such lands we can get a stand of clover or the grasses by the use of fertilizers, it is proper to apply them, though they may fail to pay on the wheat on which they are seeded. Every farmer has noticed how a small dressing of stable manure on wheat has secured a stand of clover, while the rest of the field on which no manure is applied is bare. And such is the case with a fair fertilizer—it will secure a stand of clover where it would otherwise entirely fail. No farmer should put land in wheat which will not, in the majority of years, produce a paying crop. On such land he may expect, with the proper use of a well selected fertilizer, to get such addition to his crop as will prove remunerative, and at the same time get a good stand of clover and the grasses. Land well set in these may be considered on the high road to improvement, with proper management. But much of the lands in the sections named will not, even with the use of fertilizers, produce clover.

What, then, is to be done? Sow in peas, with some fertilizer containing potash, which will produce a good crop of peas; turn these under; sow in wheat or winter oats, and in the spring with clover, and most generally a "catch" will be procured. Let this land stand in clover two or three years, fallow, lime (unless applied with the peas, as should be done), and sow in wheat again, with clover in the spring.

When we remember that stable manure is universally conceded to be a most excellent fertilizer, and recognize that its virtues consist in Phosphoric Acid, Ammonia and Potash, the conclusion is irresistible that commercial fertilizers must be valuable, when compounded of the same phosphoric acid, ammonia and potash. It may be said that the cost of the latter is too great as compared with stable manure. But the difference is probably not very much when we consider the cost of providing and getting together litter and straw for bedding, cleaning out stables, loading, and hauling and scattering manure for an acre of ground. The impossibility of procuring stable manure enough to go over the arable part of a farm, makes it almost essential to purchase commercial fertilizers, or permit the cultivation of poor ground, which "does not pay," and forego the great advantage of getting land set in clover or grass.

Dr. Voelker found the following as the composition of stable manure in 1,000 parts, air dried, viz.:

	Pounds.
Water and organic volatile matter.....	670
Ammonia	30
Phosphoric acid.....	18
Potash	20

Now, a commercial fertilizer compounded somewhat on this basis must act well. But as stable manure contains a large relative proportion of ammonia, it is the best policy to add phosphoric acid to it, and potash if the soil is believed to require it, as will be explained when we come to say something of "composts."

The instances are numerous where profitable results have been obtained from the use of fertilizers; and the fact that their use is yearly extending, shows that there are many farmers who think they are profitable. We have known 26 bushels of wheat raised on land, the owner of which thought would not yield more than six bushels without fertilizers, by the use of 200 pounds Peruvian guano and 200 pounds dissolved bone. Dr. James R. Nichols, on his Lake-side farm, near Haverhill, Mass., after sixteen years experience in the use of fertilizers, says: "During the time it has been in my possession it has more than trebled in production, and when I tell you that not a load of animal excrement has been purchased, and that the only animals maintained the first five years were a couple of cows and two horses, and during the last five years but six animals, all told, have been kept to supply excrement, you will understand that I must have sustained fertility through some other source than the manure heap. During the intervening period between 1868 and 1872, a head of seventeen animals, mostly cows, were kept on the farm, and the use of chemical fertilizers was suspended, except upon experimental fields. The production of the farm diminished during that period, and my anticipations were verified by the results." Dr. Nichols manufactures his own superphosphate, and gives the directions in his "Barn Floor Lecture" as to the mode of doing so. We explained that in a former report. He says it

does not cost more than $7\frac{1}{2}$ cents per pound, whereas the soluble phosphoric acid costs, as generally estimated, 10 cents per pound. To his superphosphate he adds nitrogen and potash, according to what he supposes the requirements of his soil. He gives the following, which he calls a *stock* or *normal* combination for a fertilizer, which he uses on his farm under proper conditions, viz.:

	Pounds.
Superphosphate lime	40
Sulphate ammonia	25
Muriate potash	25
Sulphate lime	7
Sulphate magnesia	3

Of this he applies "500 pounds per acre as a preliminary proceeding, or first dressing, to a field of unknown fertility, or crop capability, and from the results, taking into consideration not only the crop, but the meteorological conclusions which prevailed, we deduce conclusions as to subsequent treatment. This combination is serviceable for all crops." Dr. Nichols has since devoted his farm to raising hay. He lays very considerable stress upon the proper application of fertilizers in order to secure favorable results—that they must be applied with great care and skill—to be sown *evenly*, preferably broadcast—not on a *windy* day, choosing the night if necessary—must be sown as carefully as grass seed by an experienced hand, using a light harrow on corn land, to cover in the fertilizer, which should be done without delay, the object being to get all the plant food uniformly distributed and covered, or mixed with the top soil as quickly as possible. When used for top dressing on grass lands apply it in the spring, never in the fall, unless on plowed fields put down to grass; what is known as the "scratch harrow" is an excellent implement to run over the ground with, to dislodge the salts from the grass and bring them in contact with the soil. Dr. Nichols says "if these agents are of high integrity, carefully compounded, and skilfully used they will seldom disappoint those who may apply them to their lands."

These fertilizers will pay best on lands in grass, and on lands intended to be put in grass, and on lands abounding in vegetable matter, which they tend to make available for plant food; this is particularly true of lime, which decomposes vegetable matters and fits them and also mineral matters for plant food.

We do not see any reason for the opinion entertained by some that commercial fertilizers injure and exhaust land by overstimulation as they say, just as alcoholic liquors do an individual, and then leave him weak and exhausted. This can only be true so far that if a fertilizer is used deficient in one or more ingredients, that ingredient used will cause more growth of plants and cause them to abstract the natural ingredients in the soil until they become very deficient or exhausted. But if a complete fertilizer is used with proper quantities of phosphoric acid, nitrogen and potash, the just conclusion is that they will furnish the food necessary for plant growth, will cause increased growth of grasses and vegetable matter, and improve the land. Where Peruvian guano may seem to have left the land poorer it was, we think, where clover and the grasses were not used, and the land subjected to frequent cultivation, or where the guano was deficient in some one ingredient, as it sometimes was. Who can believe that stable manure exhaust lands?

IMPROVEMENT OF LANDS.

This subject, which lies at the bottom of successful agriculture, comes in appropriately in connection with the subject we have been discussing, though all improvements of land are not dependent on commercial fertilizers. There are other important agents at the command of the farmers. If farmers do not improve their lands, they will scarcely remain stationary, but will gradually deteriorate, while a small improvement annually will in time tell to the great advantage of the farm. It is not difficult for a farmer to improve his lands if he has plenty of means. He can use fertilizers of different kinds, have a large quantity of stock, raise a good quantity of manure, make composts, lime his lands, turn under clover and other green crops, &c. The farmer of small means must depend on more economical means, which should be lime, when procurable, peas, rye, oats, as green fallows, and the saving of all the manures that can be made on the farm including horse, cow, sheep, hog, and hen manure, and all the ashes should be carefully saved. Where a farmer has a larger tract of land than he can cultivate successfully, he should, if possible, sell off a portion of it, and, after paying any debts he may owe, devote the surplus to improving the balance of his land. If he cannot do this let him turn it out for some years, and after the growth attains some size, cut it down let it lay six to twelve months, burn the brush on it, and break up, then lime or marl, put in peas, then in the fall turn them under, sow in rye, which if it has a good growth may be grazed by sheep and calves in winter, then in the spring let it grow up, turn under, put in peas again, and in the fall in wheat, and early next spring in clover. This plan is particularly suited to the sections where the land will grow up in pines, which are easy to clean up and leave a good deal of vegetable matter by being suffered to lie until the next year, besides furnishing firewood. Where lime or marl cannot be obtained, this plan should be tried without them, and if the soil is good so much green manuring may be dispensed with, but we think the course indicated is best. It might be varied in this way, that is, by seeding *winter* oats on a pea fallow, if the fallow can be made and the oats gotten in by the 10th of October, then let the grain of the oats mature enough to come up, turn them under, sow peas, and the oats and peas will come up time enough to make a fallow for wheat, thus getting two crops of oats with one sowing. The liming is important in this system by decomposing vegetable matter, furnishing plant food, and promoting a stand and growth of clover. If a stand of clover fails to be obtained, fallow the land up and sow to clover alone, the last of August. Then if it fails, try it with winter oats or rye, and seed the clover early in the spring, or with spring oats seeded by first of March. Rye is a good crop to seed clover with, the clover seeded either last of August or early in the spring. It hugs the ground and protects the young clover from cold. Clover and peas, particularly with lime, are great improvers of land, especially in Eastern Virginia, and on the clover, plaster should be used wherever it will act.

In a discussion before the "Deer Creek Farmers' Club" (Maryland), reported in the November number of the "American Farmer," the subject was *Clover*. Seventeen members spoke to the question, and every one expressed himself very strongly in favor of clover as an improver of lands, and as making an excellent hay, some preferring it for hay to even timothy. One of them (Mr. Janney) said with clover and lime you can improve any land, and that no fertilizer is equal to

clover. Another (Mr. Hays) said if he had to farm without clover he and farming would dissolve partnership. Another (Mr. Ball) said that he had almost come to the conclusion that clover is the only grass seed that should be sown on arable land.

In the same number of the "American Farmer" is an essay read before the Woodlawn Agricultural Society, Fairfax, Va., by Dr. McKim, president of the "Potomac Fruit Growers' Association," in which he takes the ground that *rye* is the best crop to turn under for green manuring. His plan is to sow in the fall, with or without fertilizer, as circumstances permit, turn in in the spring, sow buckwheat, turn that in, again sow rye with clover, and permit the rye to ripen, and the grain and straw, he says, will make a handsome return, beside the improvement effected on the land. To this system we should undoubtedly add lime.

A writer in a late number of the "Country Gentleman" says his experience has been favorable with rye for green manuring, and suggests the following trial: Plow under a good crop of rye as practicable in May, then sow with buckwheat and plow this under in July or August, then follow this with sowed corn—this, we suppose, to be turned under, though he does not say so. The buckwheat in our latitude probably would not make much in the hot summer months.

We think lime is a good basis to commence on for the improvement of land, and hope to see it more used, and particularly more marl in Tidewater Virginia, many parts of which it is very accessible and has been used with decided benefit before the war, not much since; but it is time to resume it. The "green sand marl," which prevails in the upper portion of Tidewater, underlying the tertiary, or carbonate lime marl, is particularly worthy of use. It is not unmixed green sand, as seen in New Jersey, but is combined with the carbonate of lime marl. Many portions of Virginia contain an abundance of lime, and to many other portions it is accessible. The "gas lime" of Richmond is selling for 1½ to 2 cents per bushel, and we suppose the other Virginia cities are selling it as cheaply. In Baltimore it is advertised to be sold at 2 cents per bushel delivered on vessels (American Farmer, October, 1881), and this could be transported to sections of Virginia—notably, to the counties bordering the Chesapeake bay and our river counties, which do not have marl. We have tried the Richmond gas marl and are convinced it is as good form as any to use, if it is not the best. A few weeks' exposure converts the sulphuret calcium which it contains, and which is sometimes injurious to crops, into sulphate lime (gypsum), which is advantageous to many soils.

Putrescent manures may be transported short distances from the cities by railroads and rivers. We have known it thus transported from Richmond to the truck farms near Norfolk, and some farmers carry it by railroads. Mr. John B. Davis has enriched his farm "Lestor Manor," some twenty-five miles from Richmond, on the Richmond and York River Railroad, by transporting to it stable manure. But in such instances it must be costly, as it has to be transported to the cars or boats, then from where it is landed to the farms, in addition to its cost price. The writer in the "Country Gentleman," just referred to, says, "I am fully convinced from long experience in buying manure at fifty cents a load, two miles from my farm, that I could have done much better to have depended on green manures after using what manure I could have saved from my own stock. For a number of years I have depended on home resources for keeping up my farm, and have borne as good or better crops than when I bought manure, and at less expense, both of cash and muscle."

Bearing on this subject of green manuring we have recently received the following very interesting letter from Colonel J. Marshall McCue, of Nelson county, on the use of Rye and Buckwheat :

DR. THOMAS POLLARD :

Dear Sir,—For years my observation of the growth of these two crops *together*, not alone in the Valley, but in Highland, Pendleton, Bath, &c., has taught me their very great importance, but of the unsurpassed value in the light of *pasture*, that I have frequently intended to present my views on the subject to the public.

The most interesting results, as detailed in the experiment I will give you, will, I am sure, convince the most skeptical, and because of its adaptation to the large stretch of country contiguous to the Blue Ridge, from the Potomac to Atlanta, where pasture is the *desideratum*, will make it more impressive.

I spent the night of the 20th ult., at Lodebar, in this county (Nelson), with George R. Hight, Esq., a native of the county, near the Augusta border, at Midway. He is an intelligent gentleman, for some years a magistrate in the Montebelle neighborhood, that being his post-office. He gave me the *facts* herein set forth. He enclosed twelve acres of a piece of level-lying land that had been cleared for forty years, and lying out in common for twenty, and grazed close each year by all kinds of stock. He plowed it with a light barshear, about four inches deep, and on the 9th of July, 1880, sowed upon it, as turned up, $7\frac{1}{2}$ bushels of buckwheat and $7\frac{1}{2}$ bushels of Poland rye, and harrowed it in. On the first of October he cut the buckwheat, and as soon as dry enough, selected a spot with a tight sod, and flailed it out, and cleared up 180 bushels, worth 50 cents per bushel. So luxuriantly had this rye grown that in cutting the buckwheat much of the top blades were cut. He at once turned three head of horses, a cow, and several yearlings on the rye, then looking like a fall meadow in a favorable season, and except when the ground was covered by snow, they grazed it until the 1st day of May. He cut and thrashed 207 bus. of rye, of such quality that in 35 measured bus. the gain was *one and a half* bushels in weight. He just sold it in Staunton, a few days before, to Todd & Co., at \$1.10 per bushel, who pronounced it A No. 1 in quality. The pasturing caused it to *stool*, so that from one grain he counted 107 stalks, and he thinks it averaged at least 45 stalks to the single grain. The joint crops of 388 bushels brought him \$327.50, or \$40 per acre, and the saving in grain from the abundant pasture, he is satisfied far more than paid all the expenses of plowing, harvesting, thrashing, marketing, &c. Then there is a fact I should not pass by, that because of the cool, shady moist character of buckwheat when growing, clover *never* falls to stand when sowed with it. I should have mentioned that this land lies on Crab Tree Falls, a branch of the South Fork of Tye river.

Yours respectfully,

J. MARSHALL MCCUE.

In a ride up Rockfish and on the Lovington, I am satisfied the apple crop will bring far more money into all this region than wheat and tobacco combined. The widow of Dr. Hawes Coleman sold 300 barrels of pippins at \$4, and had 700 of other varieties.

J. H. McC.

The results of seeding buckwheat and rye are *very* encouraging, and no doubt they should thus be used through all this upper country. In Middle and Tidewa-

ter buckwheat does not flourish so well, and rye frequently fills badly. Mr. John Clacker, of Henrico, has recently given me some Scotch rye for trial, which he obtained through Bliss & Son—a fine white grain; he made from it 41 bushels per acre sowed 29th November. In place of buckwheat here it would be better, we think, to sow peas; they might be cut off for hay, or suffered to fall on the ground when killed by frost as a mulch for the rye and fertilizer for the land, or they might be eaten off by hogs, taking them off before they injured the rye.

This, too, would improve the land, whereas the cutting off both crops—buckwheat and rye—would not. The money value of Mr. Hight's plan would not justify the turning in of either crop. It would be best where the buckwheat and rye succeed well, as in Piedmont, to market the grain, and trust to giving the land some extraneous aid for improvement and future crops. The *falling* of peas on the land, as we suggest above, is pronounced by some who have tried it, as more improving than turning the peas in. Colonel McCue says clover *never* fails to stand when sowed with buckwheat. We suppose he means it should be sown with it in July or August, and that he does not mean to say that it would stand on Mr. Hight's plan where the rye is grazed during the winter. We have before remarked that rye is an excellent crop to sow clover with, either in August or very early in spring, as it hugs the ground and protects the young clover.

Mr. Hight's experiment shows what may be done by trying some new modes, and not pursuing always the beaten track of those who have gone before us.

In speaking of the use of lime in connection with green manuring and general improvement of land, we have not alluded to the merit claimed recently for *ground* lime stone as a fertilizer. This claim, we believe, is based on the large percentage of *carbon* which ground lime stone contains in the form of carbonic acid, which is 46 per cent., and that this furnishes carbon to plants. But it must be remarked that plants absorb sufficient carbon from the air by their leaves, or from the water that permeates the earth, and the air that pervades the ground; and besides this, decaying vegetable matter furnish a large supply of carbon. So if there is any superiority of ground lime stone over burned, it cannot be from its furnishing carbon. Besides, we generally use lime on the land after it has been air slacked, when it has abstracted a certain amount of carbon from the air, and become again a carbonate more or less complete. We do not know that plants can decompose or absorb carbonate of lime. We know that lime, when burned, prepares organic matter for plant food, besides furnishing lime as a necessary constituent of plants, and that its power of decomposing vegetable matter in the soil is greatly lessened by its being in the form of carbonate. So that we cannot see the advantage of ground over burned lime. Possibly such advantage may exist in practice, and it may be well to try it in a small way.

In addition to the modes of improving lands mentioned, all manures that can possibly be saved on the farm—horse, cow, hog, sheep, and hen manures—should be carefully husbanded, including human excrement in the form of *night soil*. We may say here that this latter, generally esteemed as a strong fertilizer, and notwithstanding we have heard so much of the Chinese saving it so carefully and drying it and pressing it into blocks for use, has been found less valuable than was supposed. Dr. Nichols says this has been established by analysis and practical trial in the field, and Dr. Voelcker coincides in this opinion. Dr. Nichols accounts for the inferiority of night soil to animal manures generally by the statement that, in addition to what is required to give muscular strength, and fat

and warmth, mankind requires something additional to give the *mind* force and power, and thus more is removed from food in the digestion by man than by animals, leaving less manurial value in the excretions. Dr. Nichols says the analyses by Berzelius and Boussingault of night soil have been singularly erroneous and misleading, and should be corrected. He says he has found the actual phosphatic and nitrogenous elements of the contents of city vaults to be far less than the estimates founded upon the statement of these chemists. If the waste of kitchens is permitted to flow into vaults and sewers, then the value is much increased, as the latter are usually very rich in nitrogenous and potash elements, making them probably more valuable than what comes from water closets. Human excretions pass rapidly through the stages of putrefactive change, and the volatile and gaseous constituents are thereby quickly lost. The disappointment which has resulted from the use of city sewage on farms around the cities of Europe, seems to bear out this estimate of the value of night soil, and the contents of sewers generally.

These manures collected on farms can be more profitably utilized by composting them, as presently to be described.

Sheep can be made to play an important part in the improvement of lands, a thing which, as is well known, has been very successfully accomplished in England on a large scale, and to a much more limited degree in this country, but which we hope is destined to extend itself, and that the time will come that Virginia farmers will arrive at the same conclusion that English farmers have, that there is no successful farming to be accomplished without sheep. A Commission, appointed by the English House of Lords, charged with enquiry into the state of the wool trade, &c., reported the testimony of a considerable number of farmers in England—some of them holding distinguished positions as farmers and men of rank. They unanimously testified that they could not keep up the fertility of their lands without sheep, or could not successfully farm without the aid of this useful animal. On our lands they are very useful in keeping down bushes and briars and coarse herbage; but more important than this, they greatly improve the lands by their droppings, which they evenly distribute over the fields, and which, being hard and compact, do not lose by evaporation their ammonia, as do other animal droppings. All this coarse herbage and briars they convert into available manure. But we know practically not much of the English system of management of sheep for the improvement of land. The English folding system has been rarely adopted in this country. A writer in the *Journal of the American Agricultural Association*, Mr. Fust, of Canada, an Englishman, who learned farming in his native country, gives us some account of this system as practiced in England. He says:

"It is a very simple business; the sheep go to fold about seven in the evening, and the next morning, as soon as the dew is off they are let out, and run on natural down pasture for an hour or two; they are then allowed to feed on some early forage plant—rye, tares, winter oats—then a few hours on the downs again, another feed of forage plants, and about 4 P. M. they graze their way along the downs to the fold. The enclosure of wattled hurdles is arranged to accommodate a certain number of sheep, so that the land may be properly and regularly manured. The calculation is, that one sheep, passing one night on one square yard of land, is equal in money value to £3 10s. (\$17.50) per acre, and it is upon this basis that 'acts of husbandry,' as they are called, for which the incom-

ing tenant, has to pay his predecessor, are valued. Think for a moment of what passes in the fold during the night. The land has been recently ploughed, the liquid and solid dejections are, therefore, easily absorbed—the oil from the fleece forming by no means an inappreciable part of them. The sheep, many of them weighing a hundred to a hundred and twenty pounds each, pass eight or ten hours couched on the same spot, and the pressure of their bodies, together with the trampling of their pointed, tiny hoofs, condense and solidify the land in a fashion that no roller, not even Crosskill's clod crusher, could hope to emulate.

* * * We can no longer afford to keep wethers until they are three years old; they must now see the butcher, most of them, before their second birth day. Still, the principle of folding remains the same; the only thing to be changed is its management. Let us see if we can arrive at the effect by a shorter or more remunerative road than the old one."

He then goes on to account for so few turnips being raised in this country for sheep, and says:

"My favorite sheep food requires no hoeing, so the wages question is settled. After a year or two, if the practice I recommend is followed out, the produce of grain will be almost doubled, and the winter food for stock will not make default.

* * * I suppose all my readers have seen the rape or caliseed, the Colza of France. They are pretty much the same thing, and either of them will make sheep ripe—fat without any other food. Cows love rape, and give rich milk on it; but care must be taken not to give it while wet with dew or rain. Insects never trouble it, and as it is sown broadcast, it requires no hoeing, and no weed can struggle successfully against it. It is grateful for manure, but on good land of moderate heavy character it can do without it. A few, say ten bushels, of bone meal, mixed with as many of ashes, will, on light soils, produce a crop so rich in its lush abundance that the eye is enraptured at the sight. If it is wished that the ewes should twin in the spring, a fortnight on rape before they are put to the ram will have the desired effect. In 1853, my Hampshiredown ewes, 250 in number, gave birth to 397 lambs. Of 15 that lambed one night came 29 lambs. They had lived upon rape from the 25th of August to the 15th of September. The plant grows so high, and is so sturdy and thick upon the ground, that sheep do not trample it down as they do grass and clover. For this reason they may be turned loose into a field of it, though the most economical plan is to divide off a piece every two days or so. If a wire is run loosely along the top, the sheep may try to jump at first; but after a few attempts the shock they receive on falling back from their spring will so astonish their weak nerves that they will shun further adventures. In this way alone can the Welsh mountain sheep, the wildest domesticated animal in existence, be kept within bounds."

Mr. Fust further says of this rape crop:

"In Kent and Hampshire, England, the farmers burn the grassy borders of their fields, and spread the ashes for this crop. It is the first crop grown on the thin, chalk soils of Sussex, the whole surface being pared with the breast plough an inch deep, and the ashes never fail to produce abundant food. The number of sheep that can be kept on an acre of rape of fair, but not extraordinary quality, may be set down as ten. If additional food be given, as cake or corn, more may be added, but alone it will fatten ten sheep, or feed seven ewes with their lambs."

He then goes on to explain how this crop, with the sheep it feeds, is a good precursor for wheat, and how the land is prepared for it. He says the English use

sheep as grain growers, while in this country they are considered only as *wool* and *mutton makers*.

We understand this rape, thus so highly praised, is the same as our spring Kale. Will not some of our farmers here try it for sheep, and as a land improver? For its cultivation, Mr. Fust says the land should be well ploughed in the fall, and cross ploughed in the spring; the harrow, grubber and roller will complete the job. The seed, from six to eight pounds, can be sown by hand, or with any of the broad cast machines, covered with chain harrows, or simply rolled in.

The mode of cultivation, depth of ploughing, and rotation of crops have much to do with the improvement of land. There has been much discussion about the advantages of deep, and shallow ploughing, some being advocates of the latter. Where deep ploughing fails to improve the land, or actually to injure its production, we apprehend it is where the subsoil is inferior, and deficient in plant food. Such soil brought to the surface, and the super soil buried, more or less impairs the yield for the time at least. Even then if some fertilizer or manure is used the deep ploughing may ultimately be of advantage. But where the subsoil is good, particularly red clay, deep ploughing, we believe, is always advantageous. On such soils four-horse plows are run, breaking the ground in some instances twelve inches or more. Major Drewry, of Westover, a most skilful and successful farmer, tells me he breaks his land at least twelve inches, and sometimes more.

A writer in the October No. of the *Southern Planter*, Mr. W. A. Parsons, tells his experience in deep ploughing on a farm in the Upper James River Valley, which cost him \$5 per acre (without dwelling or fences), and which was called there "a poor, worn-out farm," on which his neighbors told him he would starve. It is two miles back from the river, and is "a nice gray and chocolate soil, with excellent red-clay subsoil." He first grubbed and cleared up about ten acres grown up in bushes, and put it in corn, a good crop being obtained. He then followed the corn crop with wheat, and it averaged twenty bushels per acre. He used no manure, or fertilizer of any kind on either crop, and "attributes the large yield of corn and wheat simply to deep ploughing. I ploughed from eight to ten inches deep, and turned up soil that had not been reached for years before, if ever." There is a great deal of land in Virginia with good subsoil which needs just such treatment, while we are aware there is much land in Tidewater Virginia, deep ploughing of which would do no good, and might injure it. I have been much struck with and have frequently alluded to the effect produced on the clay soil where the batteries were thrown up around the city of Richmond, and have since been levelled. Though nothing but red clay, and all the top-soil buried, where these embankments have been levelled, the crops of wheat, corn and clover have been a great deal better than on the surrounding land. I have observed the same effect, where a trench for a supply pipe to the new Reservoir near Richmond was dug through red-clay soil about ten or twelve feet deep. The dirt remained exposed to the weather through most of the winter, was thrown in early in spring, and the field seeded to oats. The growth of oats over this trench, which was three to four feet wide, was nearly double that on other portions of the field, and the effect has continued to be manifest on other crops, though not in so striking degree as at first, the reason being, probably, that the soil has become run together by rains, &c., and has ceased to admit air and light so freely as at first, and because some of the plant-food brought to the surface has been exhausted by cropping. The reasons for the benefit derived from deep ploughing are obvious. Unutilized

plant-food, which has been laying dormant in the deep soil, is brought near the surface, or so stirred up as to admit the roots of plants and heat and light; a friable soil has been produced, and friability is great aid to plant-growth in all soils naturally stiff and close. In this connection *subsoil ploughing* comes into notice. That has pretty much the same effect as deep ploughing, except that it cannot injure the land by bringing to the surface any inferior subsoil or burying any productive supersoil. It may injure imperfectly drained land by admitting into the soil more water, which cannot have an outlet for want of under drains. Such land should first be drained. My limited experience with subsoiling has been favorable. I once tried it on a piece of land of eight acres, which had been in wheat. The subsoil plough followed the turning plough, and went well into the subsoil; the land was put in corn, which was an excellent crop—then it was the next fall broken up, limed with gas lime, eighty bushels to the acre, and put in oats and clover early in the spring. The oats made a heavy crop, and the first crop of clover following was pronounced by neighbors as good as any they ever saw. My ploughman, in breaking up this land for the oats and clover, wished to know of me if there was any danger of breaking up the land too deep, as the plow sank into the ground so easily, the effect of the subsoiling; whereas in such soils you can ordinarily get the plow only a certain depth to a hard pan of red clay. Subsoiling in not so complete a manner may be carried on in the planting and cultivation of the corn crop. After the furrow is laid off for the corn, run a subsoil plow or coalter along it before planting; then when throwing the dirt from the corn, follow the turning plow with the subsoil plow. This quite effectually breaks up the soil deeply, and is an excellent mode of beginning the cultivation of corn, in clay soils particularly. One of the most successful corn-raisers we know of adopts this plan. He scarcely ever fails to have a good crop of corn.

Proper rotation of crops has an important bearing on the improvement of land and the prevention of its deterioration. Crops which take the same elements of plant-food from the soil should not follow one another, and for a like reason the same crops should not, as a general rule, follow one another. There are some exceptions to this rule, as for instance, the sweet potato and fodder-corn. We scarce know why this is so with the sweet potato, except it be that the vines are left on the ground, and that the ground is well shaded all the summer with the vines, and that the vines take up Ammonia from the atmosphere.

We have the testimony of a farmer in Northampton county that he has cultivated fodder-corn on the same land year after year without impairment of production, but with rather an improvement. This crop shades the land well, is removed before it forms grain, and all the roots and stubble are left to decompose in the soil. Wheat does not generally do well after corn, because they require very much the same fertilizer, particularly phosphoric acid. Wheat does well after tobacco, because the latter does not require much phosphoric, and more potash than wheat, which requires a moderate amount. Both require a good quantity of ammonia, but fertilizers containing ammonia or stable manure are always used on tobacco, and there is enough left in the land usually for wheat. Several crops of clover may be taken from the same land because the clover abstracts ammonia from the atmosphere and stores it up in the land, and for this reason all crops do well after clover, and particularly those requiring much ammonia. Corn and tobacco are frequently injured by cut worm, when they follow clover. In the South two crops of cotton frequently, we believe, generally follow each other, and that is

one cause of the rapid deterioration of these lands. Nature sets the example of rotation of crops by causing one kind of wood to follow another, where land has been cleared up, cultivated and turned out, as original oak is followed by pine, or some other growth not containing much oak. If pine is cut down, some other growth puts up.

Besides the great improvement to lands produced by their lying in grass is the aid, which we omitted to mention, they render in preventing soils from washing off rolling lands into the bottoms and into creeks and rivers. Every observer has noticed numerous galls on our Virginia lands, the result of the washing by rains. This soil has, part of it, been carried into the bottoms, but much of it has been entirely lost in the streams, which have been rendered shallow, and in many cases difficult of navigation on this account. Keeping such lands in grass would have prevented all this and at the same time been rendering the land fertile. This washing of land on hill sides can also be prevented by ploughing around the hill sides, and leaving terraces of sod at suitable distances to catch and hold the washes from land when in cultivation.

COMPOSTS.

I must again advise farmers to use composts. By using stable and farm-pen manure as the basis, not omitting to add to it all the hog, hen, and sheep manure, if the latter have been penned near the house, and adding to this some phosphoric acid in the shape of ground bone, or South Carolina ground phosphate, or superphosphate lime (which is made by dissolving bone, or South Carolina phosphate by sulphuric acid), called also dissolved bone, and to this potash in some form, if it is supposed the soil needs it. Almost all soils, as said before, need nitrogen and phosphoric acid—some being able to do without the former, but none without the latter. Old worn soils require the potash—new lands and red-clay lands can generally do without it. This has been explained before. We would prefer for compost, if made any time before being used, ground, or South Carolina phosphate not dissolved, as in the compost heap, it will usually dissolve in time. The ground bone is preferable, if there is much need in the land for nitrogen, as it contains 4 to 5 per cent. ammonia, but it costs more than the ground South Carolina phosphate, and the stable manure furnishes a considerable amount of ammonia, and the soil the compost is intended to be used on may have a good quantity of ammonia from fallows of clover and the grasses. To this compost heap should be added rich dirt from fence-corners or ditch-banks. Some add swamp-muck, hauled up while the ground is dry in the summer. The labor of obtaining this, however, is considerable, and unless it contains a good amount of vegetable matter, or is very accessible, it is doubtful whether it pays. All refuse around the stables and house and the chamber lye should be added to the compost heap. The fermentation will pervade the mass and convert all into fertilizing material, and the dirt added will prevent the escape of much ammonia. But to preserve all the latter entirely it is best to add some plaster to the heap from time to time, unless superphosphate lime is used in place of ground bone, or ground South Carolina phosphate. The superphosphates contain a large amount of plaster, more than enough to fix all escaping ammonia. A good means of getting a supply of potash is to add tobacco stems to the heap in the fall or first of the winter. They not only furnish potash but also some phosphoric acid and ammonia. Tobacco stalks may

also be added if the tobacco has been stripped in time, say up to Christmas. As another source of potash, kainit (German potash salts) or muriate, or sulphate potash may be used. The kainit should first be analyzed, as it is very variable. It should contain 23 to 25 per cent. sulphate potash. Sulphate potash is best if the compost is intended for tobacco, but for other crops the muriate, which is cheapest, will answer. The compost should be made so that the proportion for an acre should be about 200 pounds ground bone, or ground South Carolina phosphate, or dissolved bone, or phosphate, 300 to 350 pounds kainit, or 100 pounds muriate, or 150 pounds sulphate potash. If the latter ingredients cannot be obtained, the phosphoric acid in some of the forms above mentioned, in combination with farm pens and other manures, will make a good compost, particularly for wheat or the grasses. If intended for stiff land, or new land, the potash may be omitted for almost any of the crops. Of the crops usually cultivated, tobacco and Irish potatoes require most potash.

Cotton seed, where they can be obtained, are very valuable for composting. They are much used for this purpose in the Southern States. When they are used, as they are rich in ammonia, less putrescent manure should be employed, so as to make it go further.

As to the mode of forming the compost heap, that has been so fully detailed in former reports as to make it unnecessary to describe it here. As to whether the compost should be used broadcast or in the drill, will depend upon the quantity at command. But if the land is to go in small grain, or grass afterwards, it is best to apply it broadcast, so that it will be more regularly diffused through the ground.

If farmers can possibly get the materials for compost, it is much better not to use any putrescent manure without composting it, as it can be made to go so much further. The addition of the rich dirt, which becomes impregnated with the liquid portion of the manure, and the gases given off in fermentation, becomes as valuable as the other portion, and serves to make the stable manure milder, and less apt to fire crops in hot, dry weather.

DIVERSIFIED CROPS AND NEW INDUSTRIES.

It is a bad plan for the farmer to trust entirely to one or two monied crops. If they fail, all income to any amount is cut off for the year. We may say all, because an inferior crop, made so by bad seasons, or bad cultivation, or indifferent land, costs more than it will bring in market. Of late years, our tobacco planters have made nothing by tobacco, and with many farmers this is almost the only money crop. And where a big crop is aimed at, corn and other crops are almost necessarily neglected, and the planter is in a very unfortunate predicament who has made no money by his tobacco, and then has to buy corn. Wheat is a very uncertain crop, and since the war very few good crops have been made in the State—we may say not more than one for the whole State. The census of 1880 shows that the average yield per acre for the State of Virginia has been only between eight and nine bushels. After deducting value of the seed, the cost of putting in, of getting out and shipping to market, there can be very little profit in this crop, and frequently a loss, as no crop makes so complete a failure as this. We heard of thirty-five bushels being seeded in one of the Piedmont counties, on good land, and making this year about five bushels; and on a good farm,

on lower James river, we have known not as much made as was seeded. Every farmer should raise corn, not only because it is a certain crop, but because it is "the staff of life" to the farmer, who should endeavor to raise at least enough for his own use. If his money crop or crops fail, and he has to buy corn, he is in a bad fix. He needs it for his stock, his hands, and his family, and if he has to buy it, his stock are sure to suffer, verifying the old adage I have quoted before, because it has much truth in it, viz.: "that stock will not get fat on bought corn." A distinguished old farmer used to say that the farmer who bought Western corn had better move West and raise it there. If a farmer has plenty of corn, everything on the place is sleek and fat, and there is no danger of his family starving. The Irishman is content if he has "praties" enough; he knows he can get along with very little meat; they say his expectation is twice a week. That corn is a certain crop is evidenced by the fact that quite a good crop can be made without any rain, if the land is rich and well cultivated. This year, as dry as it was, I made quite a good crop on an improved lot, which was planted thick for fodder corn, but the dry weather prevented its coming up well, and it made so much corn that the corn was suffered to mature, and the fodder was "pulled." A few ears were gathered from it as large as are to be seen in any year. It was only cultivated about three times with the cultivator, the way fodder corn is usually worked. In some sections of the State, particularly in the valleys of the Rapahannock, Mattaponi and Pamunkey, corn has been made the money crop, and some farmers have accumulated comfortable fortunes from it. In these valleys, the lands are light and loamy, are cultivated both ways, and are easily worked, requiring little hoe work. The oat is a precarious crop. In some parts of the State it does well, sown in the fall (winter oats), but in the colder parts of the State, if sown in the fall it is liable to be winter killed. In Tidewater the farmers can make more money on winter oats than on wheat seeded on like land. One fall we seeded four acres with four bushels on the 14th of October, and realized \$110 for them baled. They should have been seeded thicker, but there was more land than I supposed, and now I seed two bushels to the acre, and they should be put in, if possible, by the 15th or 20th of September, and do better if seeded last of August, and grazed if there is any danger of their getting in joint. Some time since, some farmers in Georgia determined to try thick seeding of oats, having heard of the success of some by thick seeding. They seeded, by agreement, in a certain neighborhood, four bushels per acre, and realized at least 100 bushels per acre, and some one or two more than a hundred bushels, and one 123 bushels.* We know of a farmer in Chesterfield who has seeded this fall four bushels oats per acre on very good land. Spring seeded oats are very uncertain, and rarely fill well, and had better be given up, except on very good land, whereas the most indifferent land on the farm is generally devoted to them. Rye in some sections of the State is a good crop, seeded at the same time indicated for winter oats. Forty bushels to the acre are frequently made, and this year they were selling for \$1.25 per bushel, and in some cases more. I paid \$1.40 for them, by retail, for seeding as a soiling crop. In Tidewater Virginia, in my experience, rye does not fill well. In the upper and cooler portions of the State it does. The straw of rye sells for a good price for collar making, if kept in a straight condition, generally at \$1 per hundred.

*These were "Bancroft's Rust Proof Oats," seeded early in the fall, the land being fertilized by cotton seed and peas, sowed together and turned under in the fall.

Sweet and Irish potato crops and melons pay well in some sections of the State, as does "truckin'" generally, but the sections are limited. Irish potatoes do not succeed well in Eastern Virginia; they do in the Piedmont and mountain regions, and will pay there if convenient to transportation. Sweet potatoes, melons, and "truckin'" are confined to limited sections about cities, particularly about Norfolk; and to the lands contiguous to the large rivers and the Bay. And of late years this interest has been considerably damaged by the raising of early vegetables in the Southern States, even down to and including Florida.

Fruits are not generally profitable in our State, except apples in Piedmont and in the Valley, though their cultivation, from some cause, has been limited. Grapes, too, in Piedmont are found to pay well.

Under these circumstances, we have advised the trial of the cultivation of some other crops. *Cotton* is taking hold and extending itself further north in the counties south of James river, in Tidewater, and the farmers are generally well pleased with their efforts this year in that direction, though they have had to contend with a long and severe drought. It is probable that this section can make more money from this crop than from any other crop, if they will take care to avoid the error that many planters in the Southern States have committed, of not raising corn enough to serve them, and of cultivating too much land in cotton not well fertilized and not well cultivated. Many very intelligent Southern planters are now recognizing their error, and are correcting it. The cotton raised in Virginia is found to be of excellent quality, and there seems every inducement to continue and to extend this industry.

We have previously spoken of the raising of *Sorghum*, and the manufacture of sugar and molasses from it. The latter, we think, is a well assured success, and may be made profitable; the former is more doubtful, and requires much more expensive machinery and more skill. Last year, General Le Duc, U. S. Commissioner of Agriculture, received reports on this subject from some twenty-three States, and some thirty counties in Virginia. Those reporting had nearly all been successful in molasses-making, very few attempting sugar—they having only the machinery necessary for molasses; and they had all obtained satisfactory prices for what they had made. One party in Culpeper, Va., had made 160 gallons per acre, and obtained for it 50 cents per gallon. One farmer in Minnesota made 426 gallons, and obtained for it 40 cents per gallon; and another in New York had made nearly 400 gallons per acre. Another in Tennessee says he had made 6500 gallons from 16 to 18 acres, and sold it in New York by the quantity at 35 cents per gallon. He says, "this brought me \$2,275, more than I could make from 100 acres of wheat." I have been raising some sorghum every year to feed to hogs, of which they are fond, and thrive on it. They chew it up finely, and extract all the sugar from it, and also eat the seed, which fowls are fond of also; if ground they would make good feed for cows and horses, and perhaps they might eat them not ground. But this year I raised more than enough for hogs, and determined to try making some of it into molasses, as Col. Finney, the active and accommodating Secretary of the Virginia Agricultural Society, had provided machinery, supplied by H. M. Smith & Co., Richmond. Col. Finney procured the services of three young gentlemen from the Agricultural Department in Washington—Messrs. Parsons, Wheeler and Dugan, the former of whom is a good chemist—to superintend the operation. They did so with great assiduity and skill, and with much courtesy to those making enquiries about the mode of manufacture. They

turned out for me nearly a barrel of very nice syrup, and about the same quantity for Dr. Shepherd, of Henrico, who also raised sorghum. Mine was the Honduras; Dr. Shepherd's the Early Amber, which was better matured than the Honduras, and made superior syrup. The Honduras makes much the largest growth of any other variety—at least double that of the Early Amber—but requires to be planted very early that it may have time to ripen. Mine was planted May 15, but should have been planted by 20th of April, or at least May 1st, unless the ground is too wet and too cold. The Early Amber has more saccharine matter, and is the variety best adapted to sugar making, for which purpose it has been raised considerably in the West, and we have seen a very good article of sugar made from it in Minnesota. Gen. Le Duc thinks sugar making from sorghum is an assured success, and that mills should be erected for its manufacture in every neighborhood, as are mills for making meal and flour. Others say that the difficulty produced by the gummy matter in the juice has not been overcome, and the chemists have found nothing to neutralize it. It is certain that good sugar has been made from it in the West, and that Gen. Le Duc succeeded in making good sugar from it on the grounds of the Department of Agriculture in Washington, but at what cost and in what quantity we do not know; but he reports to have obtained last year at the rate of 2,000 pounds of sugar per acre. If that quantity could be made on a large scale, and on average land, it would be a very profitable crop. Gen. Le Duc thinks it can be profitably made at 3 cents per pound. The machinery, of good character, for sugar manufacture of sorghum on a large scale, costs some \$10,000. That for manufacture of molasses some \$110 to \$120. The machinery for molasses furnished by Smith & Co., was manufactured by Blymer & Co., of Cincinnati.

As some farmers would like to know something of the process of molasses manufacture referred to, we will describe it as briefly as practicable. The cane should be ripe, which is known by the seed maturing and the stalk loosing its green color and turning brown or reddish. Then it should be stripped of its leaves while standing, which makes quite good fodder, then the seed must be cut off and secured, and the stalks cut down as wanted for the mill, though they will keep for weeks if set upon the ends and under shelter, and make as good syrup as if just cut down, perhaps better, as they may have lost some of their water. The stalks are ground in the mill, Victor* (as manufactured by Blymer & Co.), one hand putting in the stalks and another pulling them out, which is a tedious process, and it would seem as if machinery should be invented which would throw the stalks out, and dispense with the work of one hand. The juice, as soon as enough is obtained, is put in the "defeator," a square metallic box of galvanized iron. Under this is a furnace to boil gently the juice, into which is put lime mixed in water about the consistency of butter-milk, for the purpose of neutralizing the acid in the juice. Enough lime is put in to prevent *litmus* paper from turning red. This is the test: acid turns litmus paper red, and when it is neutralized by lime no change takes place in the color. Lime is used freshly slacked, and mixed with water as just indicated. As soon as the juice boils a little it is removed to the "evaporating pan," a long metallic implement of galvanized zinc, fixed on rockers, and having underneath a furnace for boiling, in which charcoal is generally used to prevent any smoking of the syrup. The bottom of this evaporator is fluted, or made into

*This has a lever horse-power, worked by two mules.

little troughs as it were, in order to present more evaporating surface, but at the ends of these (every alternate one at each end) there is an opening left for the syrup to move back and forth as the evaporator is moved on its rockers. The juice is put in at one end, and is gently moved along to the middle of the evaporator where the fire is hottest, and then passes along to give room for fresh syrup, as it is put in until the evaporator is full. As the syrup boils scum arises, which must be removed by a scoop made for the purpose. This is taken care of and given to the hogs, which are very fond of it. The syrup is left in constant motion to prevent burning until it is done, which it takes usually a little over two hours to accomplish. Its being cooked enough is known by taking some between the fingers and judging of its consistency, and by letting some of it drop from a spoon after it cools, to see if it presents a stringy character. This is a simple process, and any one can soon learn it, and the molasses, if well made, is as good as any other. The defecation by lime relieves it of any acid or other objectionable taste, which formerly made it unpopular before the lime process was used. The "bagasse," or refuse stalks after grinding, is sometimes fed to stock, but it has been deprived of nearly all of its saccharine matter, and had better be put on the manure heap to decompose and make manure of.

Major A. R. Venable, Jr., of Prince Edward county, one of the Executive Committee of the State Agricultural Society, who was present at the State Fair, states to me that he made sorghum molasses this year very successfully—that he had made from 100 to 120 gallons to the acre, and was obtaining 60 cents per gallon for it. This is a better business than tobacco or wheat culture, and we think our farmers had better try it. Some three or four farmers could unite and purchase the machinery necessary, and the cost thus divided would be small. The stalks of sorghum will keep several weeks, as mentioned, if not injured by frost. Sorghum stands drought remarkably well, much better than corn, partly, we suppose, because it is a tropical plant, and because it sends its roots deeply and broadly into the soil. This makes it, perhaps, an exhausting crop, but to compensate this nothing is carried from the farm where sorghum is raised but the syrup, and this has very little of manurial value, being a carbo-hydrate. All the stubble and roots are left to decompose in the soil; the stalks are put in the manure pile, or farm yard, and much of the grain and fodder is retained in the shape of manure.

I also cultivated this year some Link, Dark Liberian, and White Liberian sorghums. The latter, sometimes called Egyptian Corn, or Dhoura, I found did not have saccharine matter enough to make syrup or sugar successfully (though I had heard through the Department in Washington that it did), and fed it to hogs; but before I knew it the *English sparrows* had eaten up half the seed from an acre of ground. The head is a large one, closely filled with a large white grain more than half as large as pop-corn, and if ground, no doubt, would make good horse and cow feed. It is very productive, and standing drought so well, would pay to raise, particularly in dry summers. The Link, and Dark Liberian contain a good amount of sugar, and both grow larger than Early Amber, and would make good molasses, as they are very sweet to the taste.

In my "Fourth Annual Report," I spoke of *Jute* and *Silk-raising* as new industries which might succeed in Virginia. Capt. Ro. E. Lee had quite a large planting of *Jute* (expecting in the Spring to put in twenty acres), but I understand that on account of the drought it was almost a failure. Whether other persons have tried it I have not learned.

In the Spring I sent to Philadelphia (to the "Women's Silk Culture Association") and obtained some silk-worm eggs for my children to try. When hatched we fed them on Osage Orange leaves, having learned that they answered nearly as well as mulberry. But the worms were taken with disease called by the books "musccardine," said to be a fungus disease inherited from the moth that deposit the egg, exhibiting under the microscope a peculiar spores, which are believed to produce it.

This appearance was found to exist in these worms, as examined by Dr. Gray, and Rev. Mr. Huber, of Richmond, both of whom are skilled microscopists. Some few of these worms survived, completed their cocoons, and at the regular period the fly or moth emerged, laid its eggs, and died. Many of these eggs did not hatch, and of those that did most of the worms died, we suppose from the same disease. This result was very discouraging. Probably another attempt would be more successful. They are said to be prosecuting this industry successfully in Philadelphia and other points in the Northern States, and some persons in North Carolina are raising and selling the cocoons. The reeling establishments for silk are increasing in number in the United States, and handsome silks are being woven in Connecticut, New Jersey, and, we think, in Philadelphia.

The disease spoken of has been very destructive in France, still the people there prosecute silk culture with much diligence and success. The means of eradicating the disease seems to be the examination of the fly that lays the eggs by the microscope, and if the disease is found the eggs are to be destroyed. I attempted to raise some mulberry (*Morus Multicaulis*) the last year, but the drought prevailing prevented the cuttings from rooting.

I was anxious to see silk culture attempted in Virginia with the hope that its success would afford employment for many women and children in the summer months, who have not employment adequate to meet their necessities. There are many females employed in the public schools who for more than half the year have nothing to do to assist them in making a comfortable living for themselves and families. But no one in Virginia seems disposed to take hold of it. Probably the failure of its trial during the colonial times in Virginia may have discouraged later efforts in this direction, but the means of success were inadequate then, no reeling establishment for silk existing and no market for the cocoons. In an article prepared on "The Silk-Worm," by Prof. Riley, and issued by the United States Agricultural Department, the profit of two hands is put down at \$195.78 for six weeks. He says, calculating on the basis of \$1.50 per pound for choked cocoons (which is very low), the amount would be \$199.50. In Marseilles, in 1876, they were \$2.25, and in 1878 were \$1.66. Prof. Riley says Mr. Fasnach, of Raleigh, N. C., has been shipping cocoons to Marseilles and obtaining \$2.50 per pound net, the freight costing only \$3 per hundred pounds.

A good reason for believing that silk culture will succeed in Virginia is the similarity of our climate and that of France. The same similarity of climate and actual tests shows Virginia as well situated for the grape as France. The mulberry will succeed in Virginia as well as anywhere else.

We had omitted to speak of the profit to be made from selling the eggs of the silk-worm. Prof. Riley says each female silk-worm moth lays from 300 to 400 eggs, and one ounce of eggs contains about 40,000 individuals; one-half or 20,000 are females; these would lay 6,000,000 eggs, or 150 ounces; deducting one-half for loss, we have 75 ounces. These sell in Europe at an average of \$3 per ounce;

amount realized on one ounce \$225. Two adults could take charge of the issue of four ounces of eggs, and these would yield \$900. France paid in 1877 the sum of 1,691,400 francs (nearly \$340,000) for eggs exported from the United States. Eggs raised in our country are generally free from disease, and as high as \$6 and \$8 per ounce have been paid for them.

We have before expressed the opinion that *Grapes* should be encouraged as one of the new industries in Virginia. The farmers in Piedmont are making about \$100 to the acre from grape culture.

COTTON.

This is beginning, from indications given the present year, to be a prominent crop in Southside Virginia. It is in some aspects a new industry, and an old one too. We remember when a boy that almost every farmer in Hanover county raised enough of cotton to furnish cotton cloth for the household, white and black, and one farmer raised it for market, and kept it up during his lifetime. The growth, as we remember it, was not large, though it was quite productive. North of James River the climate is probably not suited well for cotton, but south of it it seems it may be profitably raised, but we trust that those of our farmers who go into it will do so moderately, not neglecting corn and the grasses and stock. There is no doubt but what cotton in the Southern States and tobacco in Virginia have been great drawbacks to improvement of lands. Cut down and wear out, and cut down again and wear out again has been the policy in the culture of these crops. We have known a good cotton plantation worn out in one State, deserted, and one not worn out (on the Arkansas river) purchased and the same system of depletion pursued. Where tobacco has been made the sole money crop a small portion of the farm has gotten all the manure and the rest has been permitted to take care of itself, and sink into poverty. Cotton, and probably tobacco, properly managed and limited, no doubt are frequently paying crops, particularly if bright tobacco can be raised, and cotton of the best quality can be produced. The fault is generally in attempting too much. No more of either crop should be raised than can be well attended to, and that without sacrificing other crops. No other crop we know of is so exacting as tobacco—the work is incessant, and if you do not worm and sucker and top at the proper time you had as well give up the cultivation, and cotton, we suspect, is somewhat like it, particularly in the picking time—the cotton worm, too, is a great trouble, and has to be attended to. We think cotton culture should be encouraged on the Southside, if the farmers will limit their crops to moderate areas, and for the instruction of new beginners and those not versed in cotton culture we propose to say something on the cultivation of this crop, as we have never devoted in our reports anything to the subject, premising that we are not practically acquainted with it. But we shall take care to say nothing on the culture of this staple that is not supported by good authority. When growing up we saw cotton raised for market on one farm (that of an uncle).

We give the following on the cultivation of cotton and preparation for market from the "Monthly Bulletin of the South Carolina Department of Agriculture," as being the best account of the cultivation, &c., of the crop we have seen.

PLANTING AND CULTIVATION.

Under the best system the land is broken up broadcast with single or double plows in the winter or early spring, but the prevailing practice is simply to turn the old beds into the alleys by running the bar of a single-horse plow to them, making two to four furrows to the bed, the usual width of the rows being $3\frac{1}{2}$ feet. This leaves an open furrow in the centre of the old bed, in which the manure is deposited as early as practicable in February and March. The furrows are then re-covered and the dirt thrown up on the manure, the bed built up again, and the land is ready for planting. The seed used belongs to the more prolific and improved varieties of short staple, and passes under the names of Dickson's or Herlong's improved, select, or cluster cotton. From one to three bushels are sown to the acre. Cotton-planters are much used, a cheap machine drawn by a mule, rolling on a wheel similar to that of a wheelbarrow, by the rotation of which motion is imparted to fingers that keep the seed moving in a hopper containing them and from which they fall into the furrow; a plow in front of the hopper opens a trench to receive the seed, and a board follows and covers. There is an arrangement to regulate the amount of seed sown, and a good hand and mule will easily plant six acres a day and do it in the best manner. The only objection to the use of the machine is the difficulty of obtaining a careful hand to work it; simple and easy as it is, practically it is found they allow the seed to give out, plant them too deep, or neglect to cover them—such carelessness, which may escape notice at the time, resulting as irreparable loss in injury to the stand. On this account much seed is sowed in a trench opened on the top of the bed, made with a plow or some implement devised for the purpose, or in holes chopped at proper intervals with a hoe. The latter method has the advantage of spacing the plants more accurately than can be done after they come up, by chopping them out with a hoe. Planting takes place about the 10th of April. The seed appear above ground in five to ten days, although when late planted, in a dry time, they may remain in the ground for four weeks, and when the rain comes still give a good stand. The work of chopping out the plants in the drill, to a stand twelve to fifteen inches apart, is commenced as soon as they are firmly set, that is when they have a height of five inches, and the third, or first true leaf makes its appearance. It is desirable to complete the thinnings early in June, in order that the plants may spread when the forms or squares are making their appearance. The after cultivation consists usually of four hoeings and four ploughings to keep the plant free from grass and the surface soil light and porous. These are completed from the last of July to the 1st of August. The plant attains a height of ten to fifteen inches before blooming, and the first blooms make their appearance from the 1st to the 20th of June. The first open bolls are seen from the last of July to the middle of August. Picking commences from the middle of August to the 1st of September. By the 10th of November the cotton is generally all picked. Black frost occurs sometimes as early as the 20th of October, but is not counted on until the middle of November, and it is sometimes deferred as late as the middle or end of December.

Cotton attains a height of two to four feet, and is most productive at three feet. Fresh upland, unmanured, yields from 300 to 1,000 pounds of seed cotton, the average being safely set at 600 pounds. Under good cultivation, even without

manure, five crops may be taken without diminishing the yield ; 1,200 pounds of seed cotton is thought on an average to yield a bale 400 pounds of lint, and the estimates of the amount required for this purpose range from 1,000 to 1,300 pounds. It is thought by some that the staple on old is shorter than on fresh land, but so nice a point is difficult to decide, and there is no general opinion on the subject.

PREPARATION OF THE CROP FOR MARKET.

The cotton is housed and carried to the gin as fast as picked, and the object is to prepare it for market with the greatest dispatch. The ginning season closes about the Christmas holidays. A variety of saw gins, the Henry, the Brown and the Winship, are employed. Mr. Gran, of Colleton, uses the needle gin. They vary in size from forty to fifty saws, require when run by horse power one mule to fifteen saws. About half the gins are run by steam engines of from six to ten horse-power; the balance by horses. The average of lint turned out per hour is 217 pounds, but it varies from 120 pounds per hour on a forty-saw Winship gin run by horse-power to 400 pounds on the needle gin run by steam. There is also a variety of presses. The old-fashioned screw is gradually being replaced by lever presses of cheap construction. Man and horse power alone is used, four men and from one to two horses packing from six to eight bales a day. Rope has been entirely replaced by iron ties for baling, and the arrow tie is generally used. Gunny bagging is used, the object being to get the heaviest in the market. Much of it is furnished from a bagging factory established in Charleston, which produces annually about the amount consumed in the State. The bales range from 450 pounds to 550 pounds, and the average 500 pounds. The crop is shipped by sailing vessel direct to New York from Horry county, at a cost of \$1.75 per bale, and all charges, including insurance, commission, &c., &c., amount to about \$3 to \$3.50 per bale. Elsewhere the crop is mostly shipped to Charleston—if by river, the Santee and the Pedee, at a cost of \$1 per bale; if by rail, on the Northeastern or Charleston and Savannah railroad, at \$1.25 a bale. The total cost of marketing, including freight and all charges when sent to Charleston, is reported at from \$3 to \$5 per bale.

The total cost of production is stated at 7 cents per pound, at 6 cents to 7 cents, at 5 cents to 10 cents, varying with season.

From the following table, taken from the statements of planters as to the cost of the labor and material expended in the cultivation of an acre of cotton, it would appear that this averages \$31.32 in the Lower Pine Belt. Such cultivation should produce a 500-pound bale, but allowing for the vicissitudes of season and taking 450 pounds of lint as a fair yield under this plan of operations, putting this at 10 cents at the gin house, we have a net profit of \$13.68 per acre, making the cost of lint cotton per pound 6 1-10 cents, or a little less than the above estimate :

Cost of each item of labor, and material expended in the cultivation of one acre of cotton.

	1	2	3
Rent.....	\$ 2 00	\$ 3 00	\$ 2 00
Fencing, repairs and interest.....	3 00	1 00	1 00
Knocking stalks	20	25	.....
Pulling and burning stalks.....	.....	.....	25
Other cleaning up.....	.....	25	50
Listing.....	.....	.....	.....
Bedding with hoes.....	.....	.....	.....
Breaking up.....	1 00	.....	.....
Harrowing .....	.....	.....	.....
Barring old beds.....	.....	50	20
Splitting middles.....	.....	25	40
Reversing .....	.....	.....	.....
Laying off.....	18	25	20
Commercial manures	4 00	5 00	2 50
Home-made manures.....	4 00	8 00	1 25
Applying manures.....	65	50	25
Bedding up.....	30	50	30
Splitting middles.....	30	25	32
Knocking off beds.....	15	.....	10
Planting—opening.....	{	25	40
dropping.....		20	25
covering		25	10
Replanting	20	25	10
Seed.....	40	40	45
Thinning.....	10	50	10
Plowing	1 75	2 25	1 00
Hoeing.....	2 00	2 00	3 00
Picking.....	5 60	5 60	7 00
Hauling to gin.....	10	10	1 00
Ginning.....	3 00	37	1 50
Management.....	1 00	.....	1 00
Wear of implements.....	40	.....	.....
Bagging and ties.....	1 00	1 00	1 00
Total.....	\$31 85	\$35 97	\$26 15
Average	\$31.32		

DISEASES, INSECT ENEMIES, &C.

It may be safely said that more injury is done to cotton in this section by grass than by anything else, and the only remedy that can be devised against this is hoeing and ploughing. Crab grass (*Eleusine Indica*) is the chief intruder. In warm and wet seasons it sometimes grows too much to weed, when heavily manured. Topping is tried as a remedy, but it is thought that under-drainage would be more effective. "Sore shin" is supposed to result from bruising the plant by careless hoeing, and is not a trouble of much consequence here. Shedding occurs in extremes of heat and cold. Rust and blight make their appearance late in July and August; they are attributed to the exhaustion of some elements of the soil, and potash is very popular as a remedy; they are likely to occur on course, sandy ill-drained soil. Caterpillar is seldom hurtful, and Paris green has been used successfully for its destruction.

We clip the following interesting article bearing on this subject from the "Southern World," published in Atlanta, Ga. :

WILL IT PAY TO RAISE COTTON?

The estimated value of the cotton crop of the ten cotton-growing States for 1879 was \$242,140,987. We pay annually to the North for wheat, corn, oats and hay \$150,000,000, which leaves us \$92,140,987. The number of bales raised for that year was 5,261,202, which cost the farmer, exclusive of fertilizers, \$45 per bale, or \$236,754,000, which leaves the pittance of \$5,386,897 for fertilizers, mules and family clothing.

The value of other crops raised by these ten States the same year was \$228,302,789. If we would devote as much time and the same energy to the cultivation of grain crops, and stock-raising, as is given to the cultivation of cotton, we would enhance the value of lands already cleared, preserve our present timbered lands, and in ten years be the most independent people of the entire country.

That cotton can be made a paying surplus crop, has been exemplified by the experience of many farmers scattered throughout the country, not on mere experimental farms. The *Constitution* of Atlanta, October 12th, publishes the statements of Major J. F. Jones, a farmer, of Troup county, Georgia, which we have condensed to prove our assertion.

Major Jones is making an exhibit at the Exposition of the products of his farm, and at his individual expense. His exhibit consists of honey, chufas, ground nuts, sugar cane, wheat, oats, rye, corn, cotton in the seed and in the bales, all grown on his farm, which is run by three horses or mules.

He says "the whole secret of success in Georgia farming is to cultivate less land and cultivate it better. There is nothing that can be raised on any land that we cannot raise successfully and profitably in middle Georgia, if we only cultivate it right. * * * * Whenever they reduce the amount of land, and intensify the cultivation, the State will be enriched as few men believe to be possible."

Major Jones having some money and considerable property at the close of the war, bought stock and hired hands sufficient to cultivate all the land he had, which was carelessly done. In a few years he had lost all but his land, and was \$7,000 in debt. He borrowed \$7,000, reduced his farm force from twenty-five to two horses. He planted and cultivated twenty-five acres of cotton in the best style, at the same time raising his own corn, wheat, rye, oats, etc. His cotton averaged over a bale to the acre. In three years he paid his debt, and greatly improved the value of his land. Last year, which was his fifth, after the reduction of his force, he averaged within two bales of one and one-half bales to the acre. He holds the certificate of two responsible gentlemen, showing that this year on three acres of land he had raised eight bales of cotton, and had gathered in their presence 2,502 pounds of cotton per acre, besides 1,600 per acre, making up to date 4,102 pounds. The cotton was dry when weighed. The estimate of top cotton yet in the field is 250 pounds to the acre.

Major Jones estimates the cost of cultivation at about three cents per pound when cultivated in this way. He manured the land with a ton and a half of dissolved bone, composted with domestic manures and cotton seed.

The crop of last year was based on twenty-one acres. He sold the cotton in the spring at ten cents. Below we give a condensed statement of the cost and production realized as per Major Jones' statement :

14,404 pounds cotton at 10 cents.....	\$1,440 40
190 bushels wheat at \$1.25.....	237 50
300 bushels corn at 75 cents.....	225 00
3,500 pounds fodder at \$1 per 100 pounds.....	35 00
500 bushels oats at 60 cents.....	300 00
Total products.....	\$2,237 90
Cash for labor to cultivate.....	\$172 00
Hands to assist in gathering.....	98 00
Cost of manure.....	153 00
Board of hands.....	108 00
Total expenses.....	\$531 00
Net profit.....	\$1,706 90

Major Jones asserts that several of his neighbors, having become infused with his spirit for small farms, after seeing his experiments, have exceeded him in the quantity of corn and cotton raised, according to the acreage planted. A grain club has been organized in his neighborhood, the members of which have determined to raise their own grain and be no longer dependent on other markets for supplies necessary to carry on the farm.

COTTON SEED AS A FERTILIZER

are much used, particularly in composts. At one time it was thought they were only good manure for corn. Now they are much used for cotton.

COTTON SEED MEAL

is considered one of the most useful feeds when used with judgment; it sells for \$30 per ton. One pound of cotton-seed meal is considered by some equal to two pounds of corn meal, and being so rich must be fed in small quantities. About two pounds a day are said to be enough for a cow that is milking, and a calf should not have more than two to four ounces, and it is so rich that pigs are said not to thrive on it, unless given in small quantities with bran, or cut roots. One pound with half peck boiled potatoes make a good feed for fattening pigs. Horses do well on it if given two pounds daily with corn meal, but if fed too abundantly the bowels are rendered costive and the kidneys become affected, by over stimulation in passing nitrogenous matter in which cotton seed are so rich. Analysis shows that a ton of cotton-seed meal contains 38 pounds of potash, 56 pounds of phosphoric acid, and 78 pounds nitrogen, and hence the value as a fertilizer and as a manure maker when fed to stock.

COTTON SEED OIL

is much used now in the world as an article of food, by diluting olive oil, for which purpose it is shipped to Spain and Italy, and the combination is sold as "pure olive oil." It is said to be used also in Maine to manufacture small fish into pure "French sardines, put in best olive oil." It is said to be a very good substitute for lard, and is much used in the cities where the mills are located; it is a great saving, as lard costs 12 to 16 cents a pound and cotton-seed oil 75 cents per gallon.

CANNING VEGETABLES AND FRUITS.

Another comparatively new industry worth noticing, and recommending itself to those well located for it, is canning vegetables and fruits. In the United States over fifty millions of dollars are invested in this business, and it is constantly extending. The most suitable locations are near railroad lines and steamboat communications, and light, warm soils are important for vegetable raising. The fruits do best in the cooler portion of the State, Piedmont, and the mountains, and Valley regions, even including peaches. The small fruits, probably, excepting raspberries, do best in Eastern Virginia. Canning requires some capital, but it may be commenced in a moderate way, and be gradually increased. Many canneries are located in cities, but it is better they should be on farms located as just mentioned, so that the jostling and bruising of the vegetables and fruits may be avoided, and on farms they can be put up within a few hours after gathering before they get stale, or in any way injured. But few farmers in Virginia have tried "canning," but those who have seem satisfied with their venture. Among those who have gone into the business, we remember now Mr. John B. Davis, of Richmond, Mr. Moomaw, and another gentleman, of Botetourt (name not remembered), and Mr. J. G. Tinsley, of Hanover. Mr. Davis has extensive establishments at "Lester Manor," his celebrated farm in King William county, on the Richmond and York river railroad, and in Richmond, to which his "Woodville" farm is contiguous, and from which he obtains many of his supplies, which are supplemented largely by purchases from raisers of vegetables and fruits near the city. In his "Woodville" cannery he is said to employ about 1,000 hands. Mr. Moomaw has established a fine reputation for his goods, particularly his canned peaches, which are extensively used, and are of excellent quality. He is said to have made his business very profitable. Mr. Tinsley is a young man who has displayed great energy and tact in conducting "canning" in conjunction with his successful farming operations. Recently we visited his establishment, and published the following account of it in the "Monthly Bulletin." Incidentally, we mention Mr. Tinsley's manufacture of his own fertilizers.

CANNING ESTABLISHMENT.

We had recently the pleasure of visiting the canning establishment of Mr. James G. Tinsley, near Atlee's Station, Hanover county, and at the same time an opportunity of visiting his well-cultivated farm, well stocked with horses, cows, hogs, and poultry, including a fine flock of turkeys.

Mr. Tinsley conceived the idea six years ago of going into the canning business, and commenced the same year, and has carried it out with great energy and business tact, and with no advertising and no newspaper puffs his goods by their merits have established a reputation that gives them a ready sale over Virginia and the South. This year he had seventy-five acres in tomatoes, and seventy-five acres in sugar corn, stringless beans, English peas and Lima beans. He has also quite a large orchard of peaches and pears. These are all raised for canning; this year he had little fruit. His land lays well, is of light soil, and admirably adapted to vegetable-raising. His cans are made at his farm, and his canning establishment is well located about a quarter of a mile from his dwelling, out of the way of fire from other buildings, and removed from all odors of stables and farm pen.

The system he adopts is what is called the "Cold pack"; that is, the goods, as he explains it, "are put in the cans before being cooked, and no hot water is allowed to get to them before they are hermetically sealed; after sealing, they are cooked; consequently they are much better than those goods that are put up in large canneries, and which are immersed immediately into boiling water and then sealed. My process takes much longer, as my cans have to be taken out of the water that the air may escape, and are then put back in the water and cooked again, whence by the other plan the cans are immersed in boiling water after being filled with fruit, and are only cooked once after being sealed."

Mr. Tinsley's vegetables are cooked in a few hours after being gathered, and the tomatoes are brought into the cannery in the same box they are gathered in to prevent all bruising and to have them firm and whole.

His goods are sold at the highest market prices, and find ready sale. He deserves much praise for his enterprise and industry, and if more of our young men would follow his example and institute new industries on farms, and not flock to the cities, they would benefit themselves and the State.

Mr. Tinsley finds it necessary to use fertilizers quite freely in raising his vegetables, and has found better results from fertilizers that he has compounded than those he has bought, and has also saved money. By experiments he says he has found out in what proportions to mix the phosphoric acid, ammonia and potash, to suit his soil. For this, too, he deserves much praise.

Mr. Davis's establishments have been frequently described in the journals of the day, and are too well known to require much comment here. We have visited that at "Lestor Manor" and find it very extensive and complete. He has hundreds of acres in vegetables, and fruits, tomatoes, garden peas, and sugar corn principally, among the vegetables; and peaches and blackberries among the fruits. We think he usually has five hundred acres in tomatoes. His establishment, besides being on the railroad, is also immediately on the Pamunkey river, with a fine wharf just at his cannery. Cans are extensively manufactured, and many hundreds of hands find employment in the summer and fall in gathering his vegetables and fruits and packing them for market. If he has not yet reaped the expected results of his enterprise, he has things now so matured and perfected and his brands so established that large profits must enure to him.

A canning establishment in every neighborhood suited to it would be a great aid to farmers in giving them a market for their surplus vegetables, and inducing those with suitable land to raise vegetables to be thus disposed of.

FRUITS.

Most of Virginia is admirably suited to all fruits which are raised in the temperate zone. Apples are raised in great perfection in Piedmont, the Mountain and Valley regions. Grapes are particularly suited to Piedmont, while Tidewater is well adapted to apples for early marketing, for melons and the "small fruits," unless it be raspberries, which require cooler localities. We do not know how they succeed in the western portion of the State, but we think they should do well there. In Tidewater they do not seem to stand well the heat and light soils, which dry off sooner and thus become more heated, but localities may be selected for them in this section, by planting on north hillsides and on loamy rich bottom lands, and on the eastern sides of fences and hedges. This is a fruit killed out

both by heat and cold, by the latter particularly where they continue to grow late in warm falls. We have observed that peaches do better in the western portion of the State and among the mountains. Blooming late, they are less apt to be killed by frosts, and are much less apt to be injured by curculio (worms, in common language,) than those raised in the eastern part of the State. They have been considerably planted in Tidewater for market, in some instances largely, but they are so uncertain that they have not proved profitable. Mr. Moomaw, and others in Botetourt raise them successfully for canning. Pears would be successful in all parts of the State were it not for that singular and destructive disease to which the trees are very liable, called "Blight." Many theories and some remedies have been proposed, but no satisfactory results have been arrived at. Blight occurs on all soils, gray or red, dry or wet, in all localities (though we think from our observation it prevails less on northern than on southern exposures) and in all sections of the State—probably more in some sections than others, though we are not informed as to this. But it occurs less in some varieties than on others, and this is an important, practical point. We think Duchess d'Angouleme, Seckel, Buffum, Beurre d'Anjou, and Lawrence are little subject to the disease. These are profitable and good varieties, and should be planted. Bartlett is a very profitable variety, and always sells well; unfortunately it frequently blights. Mr. Saunders, superintendent of the gardens of the U. S. Agricultural Department, Washington, recommends for blight a mixture of lime and sulphur, made into a wash, and applied several times in the summer. I have tried it for three or four years, and have seen no good effects from it. I only used it once in the season, and probably repetitions of it might have done better. Recently the following has been recommended—viz: one quart of sulphur, one quart of lime, one quart of bone dust, and one pint of salt, to be applied around the roots of the tree. This should be diffused under the tree, and not put against the body of the tree. Whether this prevents the blight or not, no doubt it will have a good effect on the growth of the tree, especially the bone dust, which has a beneficial effect upon the growth of all trees, and on grape vines is said to act peculiarly well. Apples may be very profitably raised in Piedmont and in all the western portion of the State. The Albemarle pippin, which flourishes particularly well in Albemarle county, is a very celebrated apple, and is much sought after, always selling well. In the English markets it has become very popular. The shipment of apples from this county to Europe, particularly to England, is increasing, and promises to be a lucrative business. It is strange that the apple-raising has not become more general in those portions of the State above referred to. It not being remunerative immediately, the trees taking eight to ten years to bear, and considerably longer (almost double), to bear full crops, is, we suppose, the principal reason; another one being the indisposition of our people to start new enterprises, and the inclination to follow along in one beaten path. The first difficulty is removed in a great measure when we remember that until the trees come into bearing remunerative crops (hoe crops) may be raised between them, so that there is little lost in the use of the land. We have published in another portion of this report a letter from Col. J. Marshall McCue, on the raising of rye and buckwheat together. In the same letter he says, "in a ride up Rockfish Gap, and on to Lovingsston, I am satisfied the apple crop will bring far more money into all this region than wheat and tobacco combined. The widow of Dr. Hawes Coleman sold 300 barrels of pippins at \$4 per barrel, and had 700 of other varieties." I have no doubt Col. McCue is right, except that he prob-

ably underrates the relative value of the apples and tobacco and wheat. The expense of gathering and marketing the former is nothing like that of cultivating and marketing the latter. We should think this would be a great inducement to raising apples—viz : the little expense attending the crop. It is true that apples usually "hit" only every other year, but that is greatly more than made up by the profit arising in the "hitting" year. We have several times seen an apple orchard on the mountain, in the gap between the "Peaks of Otter," the yield from which is usually \$1,000, and sometimes more, and the orchard is not a large one, I do not think as much as two acres.

We will here say something of the varieties of fruits to plant, as we have had some experience in the matter, and have observed closely the success or want of success of many of the fruits. In peaches the selection is not so important, as so many varieties succeed about equally, and so many of them are good, and the further fact that they rarely pay, except for family use and for canning. There are some varieties that are not so liable to be killed as others; notably among these is "Troth's Early," which we have noticed blooms out later, and is very rarely killed; it is a peach, too, of good quality. The "Early Beatrice" is another peach which seems to escape frost well. The old "White Heath Peach" is, we think, the best of all peaches where it matures; it succeeds best on light land, as do peaches generally. There is one point connected with this fruit important to point out, and that is that trees raised from the seed are more hardy and much less apt to be killed by frost than the budded or grafted kinds. The wood of the former is found to be denser and harder and more perfectly matured than that of the latter, another evidence of its hardiness. We have found by experience and observation, that peaches raised from the stone almost always come true to name, though the nurserymen think otherwise. Some years since, in buying some fruit trees, a nurseryman gave me four peach trees, the Lemon, or Willow peach (with yellow bark and white bloom), which were standing in his nursery, too large to bud on, saying he did not wish to plant them in his orchard, as he did not know they would come true. I knew they would, and planted them. This year they were the only trees that I had that escaped the general killing in the bud, when the thermometer fell to 15° fahrenheit below zero on the 31st of December, 1880. They had sufficient fruit, which, however, did not mature well on account of the great drought. Other persons told me they had similar experience with seedling peaches. Seedling apple trees, too, are found to be more hardy.

There have been some good late peaches introduced of recent years which are later and better than any we have had previously. One is sold by Mr. William Hurt, Lone Pine, Bedford; the other by Messrs. Mosby, Richmond; the former originating in Bedford, the latter, I think, in Dinwiddie. We have seen them both at our "State Fairs," held in the last days of October, and think Messrs. Mosby's peach best in quality, though not quite so showy as the Bedford peach. They are both seedlings.

Much care should be taken in the selection of apples, as they vary in quality, productiveness, and time of maturing, according to locality, soil and temperature. In the first place, before planting out an orchard, persons should diligently inquire among their neighbors what varieties succeed best with them. This is a great deal better guide than reading descriptive catalogues and listening to the opinions of nurserymen. Thousands of worthless apple trees may be found in the country.

We see them in every orchard, frequently half the whole number planted, and sometimes more. The nurserymen have discarded many of the old, tried varieties and introduced new ones, generally from the North, which do not suit our latitude, almost all the Northern winter apples turning out here to be fall apples. In the fall of 1868 I planted fifty apple trees, and though I had had experience in planting out orchards, selecting almost all of the old Virginia apples, I was led away by glowing descriptions in the catalogues and representation of a nurseryman, and planted a majority of untried ones, such as "Monstrous Pippin," "Lady Apple," "Maiden's Blush," "Rhode Island Greening," (though bought for Virginia Greening), which proved to be of no value. Among the number were some "Winesaps," which do not succeed well on clay soils, which mine is. Besides, they ripen too early in this locality to keep well as a winter apple. In Hanover county I have seen them succeed admirably, keeping well, raised on a light north-western hillside. The Winesap is largely selected as a winter apple in Virginia; besides this, for Middle and Tidewater Virginia, the Old Virginia Greening, the Limbertwig, Johnson's Fine Winter, Nansemond Beauty, originating in Nansemond county, should be planted, and perhaps others with which I am not acquainted. The "Limbertwig," though not a first-class apple, is very hardy, productive, and an excellent keeper. The Virginia Greening is very productive, a good apple, and keeps remarkably well. The "Johnson's Fine Winter" is a very handsome apple, of good quality, and said to be very productive. There are trees of it growing on the battle-field of Cold Harbor, in Hanover county, some of the apples of which have been presented to me by the Messrs. Mosby, nurserymen. This is said to be very productive and profitable as a market variety. The Cart-house or Romanite is said to succeed well in Eastern Virginia. For winter apples in the western part of the State, the Winesap, Albemarle Pippin, Big Hill, and Cannon Pearmain are principally planted. In the Valley, the Rawles' Jenet is highly prized. No doubt, the Virginia Greening and Limbertwig would also do well in the western part of the State. The Albemarle Pippin seems to be confined principally to Albemarle and Nelson, the former county raising most of them. Why they do not succeed in all Piedmont we do not know, but suppose there is some peculiarity in the soil of these two counties that favors their growth and productiveness.

In Tidewater, Virginia, winter apples usually ripen too soon to be kept through the winter. For summer and fall apples, the "Early Harvest," "Early Ripe," "June" (or May), "July" (a striped apple), "Red Astrachan," "Summer Cheese," and "Cathead" are to be preferred. They do well, we think, in most parts of the State. In addition, the "Strawberry Apple" succeeds well in Piedmont, at least we have seen it in Bedford county, bearing freely, and of fine quality. Of these, the Cheese (old-fashioned Virginia Cheese), ripening last of August and first of September, is the most valuable. With care it will keep until Christmas, is of excellent quality, trees grow very large and spreading, and bear very largely. It sells better in market than any other summer or fall apple, and is one of the most valuable apples grown in the State at any season. The Cathead, when in perfection, is the best fall apple I have ever seen, but it is rather a shy bearer. The nurserymen seem pretty much to have ignored the old Virginia Cheese and Cathead, the most valuable fall apples ever grown.

In conclusion of what we have to say about apples, we do not hesitate to say this fruit should be more cultivated in Virginia for market and for drying by evapora-

tion, of which we shall have something to say presently. Occasionally seedling apples of much merit have been found in Virginia. "Masons Stranger," originating in Greenville county, is said to have much merit, to keep well in winter, and to be much prized in the vicinity of its origin. The Porter originated in Nelson county, and has been highly praised, but we are not informed as to its merits. The Rawles-Jenet, now well known, originated in Amherst county, on the farm of a Mr. Rawles. A seedling has been found on the farm of Mr. Benjamin Watkins, of Powhatan, which he pronounces as *bearing every year*, and a great keeper, very hardy, and productive. The quality of some sent me was not very good, though I think they were gathered before being well ripe. I have discovered on my farm near Richmond a seedling apple of excellent quality and which promises to be a good keeper for winter. It bore this year for the first time, enough fruit to judge sufficiently of its merits. Its flesh is yellow, very crisp, and of superior flavor. My family pronounce it superior to the Winesap. It bore freely this year, and is now keeping better than the Winesap, which, as mentioned before, appears to ripen prematurely on my soil. The surface or skin of this apple does not seem sufficiently smooth and clear, but this, in all probability, is due to the locality of the tree, which has a road and turf on one side, and a ditch on the other, and has therefore never received a particle of cultivation. Mr. Watkins has named his apple "The Heugenot." (A colony of Heugenots formerly settled at Mannikin Town, in Powhatan). Mine has not yet been dubbed. I remember an excellent seedling summer apple, originating in Hanover county, when I was a boy, but unfortunately it was near propagated. These seedling trees deserve to be propagated, if the quality is good, because they are usually hardy and prolific.

Of the varieties of Pears we have already indicated our preference. This is a valuable fruit to raise, if we can in any manner obviate blight. Near Norfolk large amounts have been made from this fruit; we have heard as much as \$18,000 in the gross in one season on one farm. Mr. G. F. B. Leighton (Vice-President American Pomological Society), near Norfolk, exhibited at a meeting of American Pomological Society, when it met in Richmond some years since, the finest pears that were shown, surpassing in size those from California. I met this summer a farmer and fruit-raiser from the Eastern Shore of Maryland. He told me that he expected from 20 acres to obtain from 3,000 to 5,000 boxes of pears, and to get for them in Baltimore \$1 to \$1.25 per box. This is better than raising wheat, or cotton, or tobacco, by far. It seems they do not suffer as much from blight in Maryland as we do. The varieties this gentleman raised were principally Bartlett, and Duchess d'Angonleme.

Hon. Marshall P. Wilder, President American Pomological Society, lately said that if he was confined to the culture of one pear, he would adopt the Beurre d'Anjou. It is certainly a noble fruit. We have not mentioned any early variety of pear. We scarce know what to recommend. The Doyenne d'Ete is an early, good pear, but subject to blight. Dearbon's Seedling and Madeline are early pears, but small, and not of the best quality. The Rostiezer, an early pear, is said to be of fine quality. The old "June Pear," well known in Virginia formerly, but not cultivated by the nurserymen now, and never seen of late years as far as I know, was a better pear than any of the early ones that I have seen. We have no pear that keeps well into the winter. The Lawrence, Vicar of Winkfield, Winter Nells, Duchess Bordeaux, and Glout Morceaux, in the Northern States, are considered winter pears. With us they ripen in the latter part of autumn, and

rarely keep beyond the first part of December. There is a pear, originating in Hanover, Va., a tree of which stood in the garden of my paternal farm, and another at the farm of an uncle (known as Buckeye), which keeps until Christmas, and is the best late pear I have ever seen, and indeed it is not surpassed by any pear of any season, not even the Seckel. I obtained buds of it and carried them to F. Davis & Co., who are propagating them. I have a few of the trees, though have been unfortunate with them, one dying from drought after setting out in the spring, and two from blight. F. Davis & Co. have dubbed them as "Pollard's Favorite."

I have discussed elsewhere in this Report the subject of Grape culture.

Of *Cherries*, we would advise the planting of the old May Cherry, well known in Virginia—May Duke,—Early Richmond (cluster cherry), Black Tartarian, Wax, Napoleon Bigarreau (a variety of Wax), and Morella, the last principally for preserving; it is very hardy and productive. The cherry, if propagated on the "Mahaleb" stock, is believed to be short-lived, frequently dying about the time they begin to bear well. They are much more certain if budded on the cherry stock, but unfortunately the bark of that slips for only a few days in summer. We do not know, however, why they may not well be grafted.

Of "Small Fruits," we will say the most profitable and popular varieties of Raspberries seem to be Brandy Wine, Cuthbert, Philadelphia, and Clarke (Red), and Mammoth Cluster (dark). The red sell much best in market, though some think the dark kinds are most prolific. The Clarke is of excellent quality, but not so prolific as the others mentioned. The Cuthbert, judging from its fine roots and stocky appearance, seems most hardy; those we have planted have not yet fruited, but those who have cultivated it think highly of it. This fruit requires loamy light, cool soil, northern and eastern exposures, where it will not suffer so much from hot suns and drought.

Of *Strawberries*, the "Wilson" is yet the most popular market variety, being very prolific and hardy. The "Sharpless" is highly commended by those who have tried it, and some think very well of the "Cumberland Triumph," though we think it rather soft for transportation any distance. For table use, the "Charles Downing," "Seth Boyden" (very much alike), "Lady's Finger," and "Triumph de'Gand" are best, but are not very prolific, particularly the latter. "Kentucky" is a later variety of very good quality, but in my experience not very prolific. We have tried the "Monarch of the West," "Great American," the "Duchess," and other varieties, but were not pleased with them.

Of *Gooseberries*, the "Houghton's Seedling" is the most prolific and the best market variety. This fruit requires localities similar to the Raspberry, as it does not bear well, hot sun, and drought. It is profitable for market, if a ready sale could be procured for them in large quantity, at 5 cents per quart. They die out in eight or ten years, and a supply should be kept up by raising from cuttings, which is readily done, and in trimming them, small rooted branches may frequently be separated from the large bushes and transplanted.

Currants are difficult to raise in this latitude, as they are very impatient of drought and heat; but for this they would be profitable for market. The "Versailles," and "Red Dutch" are the most popular varieties. Currants, Gooseberries, and Raspberries always do better, and thrive on the eastern side of fences and pallings, where they get shade from the hot sun.

The raising of *Blackberries* for canning, we suppose, will pay, but for market

in Virginia we think they scarcely will. Our "Dewberry" (low bush, or running blackberry), which is abundant in many sections, is better than the cultivated blackberry, and this latter is very little better than our wild, high bush blackberry. Mr. John B. Davis raises the blackberry largely for canning.

The orchard products of the United States, by census of 1870, amounted to \$47,335,189. Those of Virginia to \$891,231. We suppose the increase in the last decade has been large.

DRYING OF FRUIT BY EVAPORATION.

Evaporated fruits have become very popular, and deservedly so; while the mode is destined to make a great saving for the fruit-grower, it will prove a luxury to the consumer, for fruit thus preserved, when stewed or used in pies or sauce, is almost like fruit taken fresh from the tree in the summer. Fruit thus dried sells for 12 to 15 cents per pound, while in the old way of drying it brings only about 8 cents. We have always thought that fruit dried in the ordinary way was not very healthy, because it is frequently caught in showers or subjected to dews, and more or less fermentation is produced, which renders it acid, and unhealthy. By the evaporating process this is avoided and the natural flavor of the fruit is very much retained, with a color bright and attractive, with no worms as in the sun-dried fruit. We have tried the evaporated fruit, and can scarcely tell it from fresh green fruit, only the water is driven off, not the sugar or the flavor. This process, besides saving much fruit which would otherwise go to waste, is a decided saving to the consumer. Apples cost \$4 or \$5 per barrel; this will make 15 to 20 pounds of evaporated fruit, say 16 pounds, which will cost not more than \$2.50 or \$2.75, without the danger of the fresh fruit rotting or being damaged by carriage; the fresh fruit must be used up at once or it rots, while the evaporated fruit can be kept for a long time. There are quantities of apples and peaches which are specked a little, only "skin deep," but yet enough to prevent their profitable sale in barrels fresh, that after they are peeled are as good as any; they are otherwise thrown away, and thousands of bushels of apples, pears, peaches, cherries, and plums are thus lost which may be saved by evaporation. Mr. Purdy, editor of the "Fruit Recorder," New York, in commenting on this business, says that "evaporating fruit is a grand thing for fruit-growers." He says on conversing with one of the most extensive fruit dealers in New York city, he asked him whether there was danger of overdoing the business. The reply was, "the business has hardly begun; the world is open to this trade—the whole shipping interest; the great sections of the world, too, where fruit like ours is not grown, and cannot be kept in a fresh state; armies, navies, hospitals, yes millions upon millions of people to be supplied. Don't you be troubled about its being overdone in your day." Mr. Purdy goes on to say that the process has caused a rise in fresh fruit, and instances particularly the black raspberry trade in New York, the demand for the plants of which is now unprecedented on account of the rise in the price of fruit, caused by its being dried by evaporation. Mr. Purdy recommends the Williams Evaporator. The evaporators can be gotten through our manufacturers of machinery. We have before us a circular from the "Zimmerman Fruit Dryer Company," Cincinnati, which may be obtained through Mr. Ashton Starke, of Richmond. The price of the regular size, with wood racks, is \$45; with wire racks, \$50. It may also be used as a baker and roaster. It is claimed that it will bake

15 loaves of bread and 40 or 50 pies at a time, and that it will roast meats, turkey, chicken, and game in their own juices, without any fear of burning, and that it will also dry clothes as well as any clothes-dryer in the market, and when not in use may be used as a safe for keeping bread, milk, cold meats, &c. Besides fruits, sweet potatoes, onions, corn, squash and pumpkins also are dried. We saw a sweet-potato raiser from Hanover, a short time since, inquiring where he could get this fruit-dryer from in order to dry off his potatoes for more perfect keeping. We were rather surprised at this, knowing how well and perfectly our Hanover friends keep their potatoes, but it was stated that with the best management a considerable quantity of potatoes were lost. It is stated that by the Zimmerman Dryer—

1 bus. apples will yield 6 lbs.	cost 3 cts. per lb.;	market value 15 to 20 cts. per lb.
1 " peaches, pared, 5½ "	" " " 7 "	30 "
1 " " unpared, 8½ "	" " " 3 "	15 "
1 " of pears, 7 "	" " " 7 "	25 "
1 " blackberries, " "	" " " 8 "	20 "
1 " raspberries, 8 to 10 "		30 "
1 " sweet potatoes, 15 "		20 "
1 " onions, 6 "		45 "
100 ears sweet corn (50 lbs) 8 lbs,		12 to 15 cents.

We omitted to say anything about *Quince* raising. The Quince sells well, though it does not seem productive in our latitude. This may be due to want of proper cultivation. The tree requires stiff good land, and good culture. It does best in bush form, permitting the branches to start about a foot from the ground. It is usually planted twelve feet apart; if the land is not rich, it should be manured every year to get good crops. The Orange Quince is the most popular variety.

SALT AS A FERTILIZER.

We have been frequently asked about the propriety of the use of salt as a fertilizer, a question which does not appear to be definitely settled as yet. If it was a very decided and direct fertilizer, like ammonia or phosphoric acid, we suppose the question would have been settled in its favor. Still there is evidence of its value as a manure. We remember reading some years ago, in the *Southern Planter*, quite an elaborate article on this subject from Judge Hughes, who is so well informed upon a great variety of subjects. He quoted quite extensively from the experience of English farmers, and from authors principally English, to prove its value. In a full discussion before the "Massachusetts Agricultural Society," composed of probably the best informed farmers in the country, the following conclusions were arrived at: "That salt has the property of hastening the maturity of all grain crops; that wheat on salted land will ripen six to ten days earlier than on unsalted land, all other conditions being equal; that it increases the yield from 25 to 50 per cent.; that it stiffens the straw, and prevents rust and smut; that it checks, if it does not entirely prevent the ravages of chinch-bug. That the best time to sow salt is in the spring early, so that subsequent workings may diffuse it through the ground; that the best method of sowing it is to sow it out of the rear end of a wagon, the sower using both hands, while the team moves slowly; and in this way thirty to forty acres may be sown in a day; that two barrels

per acre will injure no grain crop." We should think 300 pounds, or five or six bushels might be safely used, and can see no objection to sowing it in the fall on land intended for wheat, dragging in the salt before the wheat is seeded. We have been in the habit of using it almost every year on asparagus, one year as much as 20 bushels to the acre, and generally as much as 12 bushels, but have seen no good or bad effects from it, except to keep down the grass the year in which it is used. But now after using it for eight or ten years as much grass comes up as ever. I have left out beds of asparagus without salt to see if I could note any difference in the growth of this vegetable, but have seen no improvement in the size of the asparagus stalks. Probably the improvement should be looked for in the second year.

If the conclusions of the Massachusetts Agricultural Society are correct, then certainly salt should be more used as a fertilizer. Its cost is moderate, as agricultural salt is cheap.

DAIRYING, CHEESE AND BUTTER MAKING.

We are surprised that more attention is not paid in Virginia to the production of milk, butter and cheese. Dairying is a laborious business, but it pays well near the cities, if well attended to, and aids very much in the improvement of lands. Even if the direct profit is small, the making of manure will pay a good profit. In the Northern States, milk is sent long distances to market by the railroads, and the dairy interest there has assumed very large proportions, and is increasing. Butter and cheese making in Virginia are carried on on a small scale, and we cannot tell why this is, and particularly why our people make so little cheese. They will be forced to go into new enterprises in view of the grain competition of the great West, and these industries it is well to look to, as have done many of the Northern States, notably the State of New York. We have not the returns of the census of 1880 in dairy products. In 1870, by census, the cheese amounted to 162,927,382 pounds, and the butter to 514,092,683 pounds; no doubt the increase in both has been very large since that time.* Of these amounts just given, New York furnished about one-fifth, and Virginia is not put down in the list at all. American cheese is finding a large sale in Europe, particularly in England, so long noted for the excellence of this article. We can, from our natural advantages, undersell English manufacturers of cheese in their own markets. As to butter, we at the South know very little as to its proper manufacture, and scarcely anything about cheese making. Mr. Crozer on Long Island gets 75 cents per pound for all his butter, and we are told of some manufacturer of this article, near Boston, who gets \$1 per pound. This of course is due to their skill and management. Believing it not improper that our butter makers in Virginia should color their butter, as is so largely done at the North, with increase in its market value, I wrote to Mr. Crozer to enquire if he colored his butter, and if so, with what preparation. He replied that he only colored it with *Lucerne*. We were surprised at this, as we know *Lucerne* is little raised in that latitude. Flint states that *Lucerne* is not profitably raised north of Philadelphia, on account of the cold, and south of it, on account of the heat. In the latter we think he must be mistaken. It succeeds well in France, in Germany, and in the Southern United States, at least in Georgia, as we are informed by Mr. Howard in his work on

* The Census General Returns for 1880 have not yet been published.

"Grasses for the South." Mr. Crozer referred to a party who would furnish the "butter coloring," Mr. Thurber, and he to Mr. Thatcher of New York. As all these butter colorings are made from an innocuous substance (Annatto), there can be no objection to using it. Almost all cheeses are colored, and no one objects, in fact persons are unwilling to buy a white cheese, or white butter, showing how much appearances have to do in controlling our taste. We know of an instance of a lady who could not get more than 25 cents per pound, and that with difficulty, for her white butter, and obtained easily for it 35 cents per pound when colored.

Mr. Thatcher, in a letter to me, stated that he was a practical butter maker; that he had instituted many experiments in its manufacture, and was convinced that the art was yet in its infancy.

We had best give his letter in full, as it is instructive and interesting :

POTSDAM, N. Y., March 1st, 1881.

DR. THOMAS POLLARD :

Dear Sir,—Your letter was forwarded to me by Mr. Thurber. In relation to butter color, I have to say that on page 19 of the "Dairymans' and Farmers' Guide Book," which I send in another envelope to you this day, I make something of a statement of my manner of arriving at what I call a very fine combination for a butter color. My work in that direction has been done largely by the use of the microscope. I purchased hundreds of gallons of cream for my many experiments, and it required persistent labor to find an article that will do this work, and do it satisfactorily.

2d. Your question as to the works on butter-making. There is no work exclusively on butter-making. "The Dairy Cow," by the Sturtevant Bros., South Farmington, Mass., takes up the subject in part. A work on the Jersey Cow, by W. P. Hazard, devotes a number of pages to butter-making, but I know of no good work on the subject. On page 22 of my little work is an article on butter-making. Butter-making is just in its infancy. The time will come when milk will either be set in deep pails and the cream taken off in layers, so that the larger butter globules may be churned by themselves, and also the small ones by themselves, so that all this butter may be secured, or else dairies will have to be graded for the large and small butter globules. Your mission is to teach agriculture, and among its finer developments you ought to teach butter-making, and also the making of the color. In the former there is room for much study. 1st. The Jersey cow's butter globules are large, about one-four-thousandth or one-five-thousandth of an inch in diameter. The enveloping membrane is delicate and tender, and therefore the cream ripens, so to say, and is ready to churn in 30 to 36 hours after it is taken from the milk, and if the temperature is maintained at 58° to 62°, according to season, it can be churned in 12 to 20 minutes. Holtstein and Short Horn cows' milk has a butter globule from one-six-thousandth to one-seven-thousandth inch in diameter, and therefore the cream is longer in rising for the reason that the specific gravity of the butter is less than water or milk, and the specific gravity of the enveloping membrane is about the same as water. The membrane is thicker on last named globules than on the milk of Jersey cows, therefore the small globules is longer in rising, longer in churning (30 to 50 minutes), because this membrane is tougher. If the cream falls to a very low temperature, in the milk or in the cream, it must be churned sometimes 70 min-

utes, or it will not come; on the contrary, if cream is allowed to reach a high temperature, in rising 70° to 80°, it must be churned at 53° or 55° to make good hard butter.

To give rank to butter color, I buy every butter color made in the United States or Canada, so that I can rate them, and feel sure that I surpass anything yet made. Probably this is why Mr. Thurber sent your letter to me. You will find solid reading in an English work by Arther Hassell Hill, entitled "Food and its Adulterations," a work of 1,200 pages. He has been in the employ of the English government twenty-five years. It is a heavy work, and goes into matters scientifically and microscopically. Pardon my long letter, and allow me to subscribe myself, very truly yours,

H. D. THATCHER.

Mr. Wagner, druggist, Richmond, has this butter coloring for sale. I tried it, and found it answered a very good purpose.

By the census of 1870 the milk in the United States amounted to 235,000,000 gallons, and the cheese to 53,000,000 pounds. No doubt both these items have been very greatly increased since then.

MINERALS IN VIRGINIA.

Of late years the interest in the mineral districts of Virginia has assumed large proportions. Our people have known for a number of years that we had large quantities of iron, that we had a gold belt running through Virginia, that we had large deposits of coal in Chesterfield county, some in Powhatan, and natural coke in Henrico; that we had vast beds of granite, potter's clay, &c. (though the city of Richmond sent to Massachusetts, we think, for *sandstone* to build her City Hall, now demolished, in place of using the granite at her own door); but it is only recently that we had any conception of the vast amount and unsurpassed quality of our iron deposits, of the extensive gold ores, of coal in large quantities in Wise, Scott, and other southwestern counties, and through much of the Valley of Virginia, of our copper, of unsurpassed zinc (in Pulaski especially), of marble, of manganese, of lead, silver, salt, and gypsum (in great quantities), of kaolin and spar of the best quality for the finest porcelain, of superior mica, and of almost every known mineral; we may probably except tin. Added to this there are extensive deposits of lime in the western portion of the State, and vast beds of marl in Tidewater Virginia, which are destined to play important parts in the renovation and improvement of our lands. Before investigating the mineral resources of the State, I had no conception of the quantity and value of our *iron*, and even now it is difficult to appreciate or estimate its great value. We have through the Valley of the James, through Pittsylvania and other southern and southwestern counties, through most of Piedmont, through the Valley and mountain regions immense quantities of iron, much of it equal to the best Lake Superior ores. In Bedford county I saw last year a mountain of red hematite of superior quality, with a great deposit of lime adjoining it, besides large beds of brown hematite and magnetic ore in the same vicinity. Botetourt, Alleghany and other counties are similarly blessed, and we have reason to say that Virginia could furnish the world with iron for the next thousand years and not begin to be exhausted of this valuable metal. In no State can iron be more cheaply mined and worked than in

Virginia. Many other minerals are destined to play important parts in the development and future prosperity of Virginia, but we have not time or space to further discuss the subject. But having occasion last summer to investigate the gold interests of Virginia, it will not be inappropriate to give here the results of this enquiry.

The following paper, while not agricultural, is on a subject of much interest to many land-owners in Virginia, and bears upon the general interests of the State. It was prepared in response to a letter from Mr. Alfred G. Lock, F. R. G. S., of England, to the Governor of Virginia, requesting information about the gold mines and gold mining in Virginia. Mr. Lock is preparing an elaborate work on "Gold: Its Occurrence and Extraction."

It was thought best to publish the article here before sending it abroad.

Dr. W. B. Gray, of Richmond, well versed in this whole subject, has kindly prepared an article on gold mines and mining in Virginia, to accompany this article. (Both were published in the *Monthly Bulletin*.)

THE GOLD BELT OF VIRGINIA.

BY THOMAS POLLARD,

Commissioner of Agriculture of Virginia.

The "Great Gold Belt" of Virginia extends from Fairfax county on the north, to Halifax county on the south, a distance of about 200 miles in length by 15 to 25 miles in width, embracing an area of at least 4,000 square miles. A large number of mines have been opened along this belt, particularly in Fauquier, Culpeper, Spotsylvania, Orange, Fluvanna, and Buckingham counties. More recently alluvial gold has been discovered in Montgomery and Floyd counties, on the lands bordering on Brush creek. The proportion of gold there is 20 to 75 cents per bushel of earth. The largest particles yet found are worth about fifty cents. Gold is found everywhere for miles up and down Brush creek and its tributaries. Later information, says the *Montgomery Messenger*, is that several pieces have been found worth \$1.25. The "Gold Belt" of Virginia is composed of a series of granitic, syenitic, steatitic, chloritic, and other rocks peculiar to this section, striking northeast and southwest with the belt, and dipping at high angles, or standing nearly vertical. Stratified with these are numerous veins of gold-bearing quartz, seams of magnetic, specular, hematite, and other ores of iron, trapdykes, &c. The gold found in these materials varies in value from \$1.30 to \$1,000 to the ton. An average 100 tons from the surface downwards is estimated as worth \$932.32. (Report of Richmond Chamber of Commerce.) Assays of samples from the Franklin mine in Fauquier county, made by R. D. Irving, of New York, in 1870, gave for 200 pounds of materials from the veins an average value of \$46.40 of gold, and \$1.48 of silver; in another, \$72.55 of gold, and \$0.41 of silver; while another gave net \$2.32 of gold. The mean assays of ten samples was \$24.24 to the ton (of 2,000 pounds). Large numbers of mines have been opened along the "belt," notably in Fauquier, Culpeper, Spotsylvania, Orange, Fluvanna and Buckingham counties, and from these and gatherings from the surface and soils \$1,662,627 worth of gold had reached the Philadelphia mint up to June 30, 1871. "If the same skill and capital were employed here as in California, these mines, in the opinion of practical miners, would yield as well as those of that noted gold-producing State. Silver is associated with some of the gold-bearing rocks above enumerated, especially the

chloritic slate. Copper pyrites are abundant in all the 'gold belt.' Carbonate of copper is also found." (Hotchkiss' Summary of Virginia.)

The gold interest of Virginia has suffered much from speculation. A party secures specimens, hurries to Northern cities, gets up a company of speculators, who develop the mine enough to sell to another company of speculators, and so the business has been conducted. In California and other new countries, men who go there to mine have to depend on their daily work for support, and are forced to work systematically and industriously, or fail in supplying themselves in food and clothing. If this had been the case in Virginia, instead of buying and selling mines on speculation, the gold interest would have been in a very different condition. In Virginia the deepest mining for gold has been not over 150 feet, while in California shafts have been opened 1,000 to 1,400 feet. Dr. Gray's letter accompanying this communication proves conclusively that we have gold mines in Virginia which will pay liberally if properly worked and managed. The many speculating schemes which have been inaugurated and failed, have made people adverse to believing in the gold belt of Virginia; but now that the gold yield of California is falling off, and capital there invested is not yielding so satisfactorily, capitalists are turning their attention to Virginia, and a fresh impetus has been given to this industry in our State. Prof. Silliman, an eminent American geologist, and Prof. William B. Rogers, then of the University of Virginia, (and who made a geological survey of Virginia between 1843 and 1848), in 1836 made a personal inspection of the gold mines in Virginia, and each published statements of the true character of the veins, of which they formed a very favorable estimate, the average assay of those they examined reaching \$165 to the ton. Since then, Prof. M. H. Stowe, now of Washington city, formerly located on the Franklin mine in Fauquier, Va., a practical mining engineer, has made a careful study of the Eastern gold belt, being previously well acquainted with the Western, and has given the results of his observations in the *Mining Record* of New York. Prof. Stowe writes to the *Record* "that Dr. Endlich, of the Smithsonian Institute, had made an examination of the geological formation of the veins in Virginia, and pronounced it to be the same as that of California, on which the best paying mines occur," and Prof. Stowe further states "that Dr. Endlich confirmed him in the views he had long entertained that the veins were *true fissures*." ("Gold Interests of Virginia and the South"; John Tyler in *The Southern Review*, January, 1879.) We quote further from Mr. Tyler's article:; "Captain, Riley an experienced mining engineer from the Pacific Coast, who made an examination about the same time, and from whom Prof. Stowe quotes, says of one of the mines in Fauquier county, Va., 'that with the advantage of location, facilities for economical working, vast extent, and richness of lode, this property has great intrinsic merit, and deserves to be classed among the foremost gold mines of this or any other continent.' It is important to notice the opinion of Prof. Stowe, concurred in by Dr. Endlich, that we have true 'fissure veins,' instead of sedimentary or deposit veins. This gives greater value, as it promises an almost inexhaustible supply; for in 'fissure veins' the ore increases in richness as you descend, and although the free gold diminishes, yet the sulphurets increase, and the latter can be so successfully worked with the present improved methods, that the additional metallic value far exceeds the additional cost of producing. This has been proven in North Carolina, where they have mined to a depth of 600 to 700 feet. Nowhere else in the East has deep mining been tried." The deepest in Virginia for gold

is from 120 to 150 feet. Mr. Tyler, after saying that practical mining engineers who have made an examination of the Eastern gold belt state that the true method for continuous and large yields was *deep mining*, expresses the opinion that the want of this is a prominent cause of failure. He says: "It has been the case from Virginia through to Georgia, with the one exception in North Carolina, that mining has been carried on in the majority of cases only to water level, and in only a few cases below 100 feet. * * * Experience proves that the proper system is to go deeper."

Many gold mines have been worked in Virginia from time to time. Want of experience and of proper machinery, want of sufficient depth, speculative investments with no expectation of working them, except enough to get up a company and sell out, with a repetition of this by another company or individuals, have caused failures and suspensions of many of the mines. The late "civil war" caused a suspension of all mining, save iron, coal, saltpetre, and sulphur. Within the past three years the interest has revived, and a considerable number of mines are being worked, particularly in Buckingham, Fluvanna, Goochland.

In some localities the yield has proven quite large.

In Goochland county we have the "Bertha and Edith," "Tabb," "Belzora," "Fisher," "Gilmer," "Marks," "Waller," "Moss, or Scisson," "L'Aigle d'Or"; in Fluvanna county, the "Tellurium," "Bowles," "Perkins," "Jennings," "Fontaine," "Snead," "Hughes"; in Louisa county, "Walnut Grove," "Slate Hill," "Louisa," "Profit," "Luce," "Walton," "Morrison," "Baker," "Tinder Flat," "Alley Cooper," (the latter contains a considerable portion of silver and lead mixed with the gold); in Buckingham county, the "Moseley," "Booker," "Lightfoot," "Allen," "Hobson," "Rough and Ready," "Duncan's," "De Sear, or Appleton's," "Buckingham," "Greeley"; in Fauquier, "Franklin," "Bancroft," "Wykoff," "Ellis," and perhaps others, and several in Spotsylvania, names not known; in Orange, "Vancluse" and "Melville." The "Tellurium," located partly in Fluvanna and partly in Goochland, has produced the most gold of any of those enumerated. It was worked for many years by Commodore Stockton, and has produced since its first working about \$1,000,000, though it was never worked below 120 feet, the depth of the free gold, the sulphurets, now known to be most valuable, having been thus lost. It is this mine that Dr. Gray speaks of at length in his interesting communication.

Mr. Tyler quotes from Professor Stowe (from a letter written by him in 1873, just after his return from California and Colorado), regarding his estimate of the value of the Virginia mines. He says: "I am now of the decided opinion that the ores of Virginia are the richest and easiest to work of any I have ever met. I have made over two hundred assays of ore from the Atlantic Slope, and have visited in person many of the localities where gold is found, and I speak from facts." This is a strong opinion coming from an expert mining engineer. Mr. Tyler says that his opinion concerning the value of deep gold mining is fully concurred in by Prof. Stowe, and by Hon. A. S. Hewitt, President of the "American Institute of Mining Engineers," who says in his Centennial address "the principal reliance of our gold mining industries for the future must be quartz, and by hydraulic and deep-gravel mines. These may be expected to maintain for years to come their present rate of production, if not to increase it." The same gentleman, in his address, gives a strong reason in favor of our Eastern mines, which are at our very doors, with cheap labor and materials close at hand. Mr.

Tyler quotes from Prof. Stowe as to the value of the sulphurets—their value in the East as compared with their value in California and Colorado. The former are far richer, and can be easier worked.

Prof. Stowe says the average yield from sulphurets in California is \$91 per ton, from Colorado \$128, and from Virginia mines \$166, which shows largely in favor of the East. "Besides the cost, he says, of working sulphurets in California by the chlorination process is \$10 per ton, while in Virginia it ought not to exceed \$3.50 per ton. This difference of more economical working in the East applies to all branches of gold mining, for the average cost of mining and milling in California is between \$8 and \$9 per ton, while in the East it is only a little over \$2." After speaking of the great value of the copper and iron pyrites in Virginia, he says: "I do not know of any other section that offers such inducements to capitalists as our gold mines here in Virginia. What has been done elsewhere in saving the precious metals, and utilizing concentrations, can be done here, and with much less outlay of capital. What would cost here very little in the way of exploiting mines, would cost from \$2,000 to \$5,000 in Colorado, Utah, and Nevada. No investments in railroads, manufactures, or farming lands, will pay such large dividends for the outlay as will the gold mines of Virginia, when handled with the proper skill and energy."

Prof. Stowe, in an article published in the *Piedmont News* (Culpeper, Va., August 30, 1877), says: "The Placer mines of Goochland county are now successfully worked by the hydraulic process, which is so extensively and profitably carried on in California, and there are several other counties in the State where the hydraulicing could be made to pay well. Much may be expected by the proper employment of this process in Virginia. It can be worked much more cheaply here than in the West. In many places in California the cost of water alone per year would be a snug fortune, while here it can be had for nothing. * * It has been asserted that hydraulicing will pay a profit in this State, if the soil yields 15 cents per ton, provided other conditions are favorable. I know, in one place in particular, where the soil would yield that much to the pan, and often more. I have seen as much as \$4 washed from one pan of dirt and gravel. There is plenty of water not far distant, but for want of capital and brains this valuable Placer mine is idle. Its past history would indicate there is several fortunes in it. The several years' experience I have had in Virginia teaches me the importance of, and the necessity for, a cheaper ore crusher than we have at present. The apparatus should be portable, and not weigh over 200 pounds. It should require no expensive foundations, and be so constructed as to be run by horse power, if desired, and crush to the requisite fineness 500 pounds quartz per hour. * * * We need also a cheap and effective process for saving the gold after the ore is crushed. This process should be simple, and easily worked by any one of intelligence. The gold-mining interests of the 'Old Dominion' have been seriously affected by a great many costly and useless processes, which have done much more harm than good."

Professor Stowe, in another article in the same paper, describes some of the gold mines in Culpeper, Orange and Fauquier counties (the "Vancluse," "Melville," "Old Culpeper Mine," "Ellis," "Bancroft," "Kidwell," "Waterman," "Franklin," and "Wykoff"), and gives the cost of mining and milling at one of these mines at \$2.20 per ton (the Ellis mine) in Culpeper county, superintended for three years by himself, and then compares it with the Taylor mine in California,

where the cost, according to the report of the United States Mining Commissioner for 1875 was for mining and milling \$9.95 per ton, and by the same report the average cost in twenty-seven leading mines in California, mining and milling was \$8.26 per ton. Describing one of these mines, the "Wykoff," in Fauquier, he says the geological features at the Wykoff present the same general characteristics that prevail elsewhere on the line of the gold belt. The country rock is talcose slate, and the strata are nearly vertical. The decomposition of this rock forms the excellent soil referred to. * * After describing the different veins, one of which is 20 feet thick (the "Mill House" vein), he says: "I have made careful analyses of samples taken by myself from these veins, with the following results: 'Mill House' vein yielded \$41.28 per ton; 'Tunnel' vein, the ore of same value; from the Slate vein the clean sulphurets gave \$89.18 per ton; in another vein, known only by its out crop, the clean sulphurets yielded \$623.10 per ton; another vein, which contains copper pyrites, yielded of pure gold \$30 per ton."

We find in the *Richmond Whig* (August 22, 1876), and *The Mining Record* (September 5, 1878), articles from Professor Stowe on the values of the sulphurets of Virginia. He says: "Nearly all the gold-bearing veins of the State carry the gold in sulphurets, or at least where they have been. In the lower level of our mines the sulphurets will contain at least 80 per cent. of all the gold in the ore, and hence the importance of the capitalist and miner knowing their value in practical mining operations. I have made numerous tests of Virginia sulphurets, and have been taking great pains to get them from every gold-bearing county in the State, in order that I might get at the facts. I have access to the assays of others, so as not to allow myself to be deceived. So far as I can learn, the assays of auriferous sulphurets in this State are higher than the average of like ores in the Western mines. What I mean by 'sulphurets' is pyrites of iron, copper, and galena, which are found on the line of the 'gold belt.' No antimony has been found in our gold mines, and some experts deny the existence of arsenic. Only traces of zinc are found, and we have no refractory constituents in our sulphurets that are found in the West." Professor Stowe gives the analysis of the sulphurets of seven Virginia mines and of seven California mines, the former based on his own experience, and the latter taken from the "United States Mining Commissioner's Report," and says "it will be seen from the above that the average yield of gold from the sulphurets of seven Virginia mines is greater by \$75 per ton than the average of a like number in California. These averages are not from selected mines particularly, but from those whose yield of sulphurets could be ascertained. There are many mines in the States above-mentioned that would furnish sulphurets giving a much higher, and some a much lower yield than the averages above-given respectively, but I do not believe the ratio would be much changed. * * * It is hard to tell with certainty what will be the metallurgical treatment of sulphurets in this State. Chlorination is the leading process in California, and will probably be introduced here before the close of the present year (1876). [It has been introduced to some extent]. Several other processes for the treatment of gold ores are to be introduced shortly, and among them there may be something as effective as chlorination, and much easier, requiring less chemical manipulation. * * * In California the cost of working ores by the chlorination process is about \$10 per ton. In Virginia it ought not to exceed \$3.50 per ton." Professor Stowe speaks of assays made by him of the sulphurets of the "Home Mine," Appomattox county. He says: "I have recently made several assays of the

'Home Mine,' taken from newly-opened veins, with the following results : Shaft No. 3, per ton, \$206.70 ; shaft No. 4, per ton, \$261.68 ; shaft No. 5, per ton, \$219.10 ; average, \$229.16."

Professor Stowe describes a mine in Fauquier county on the "Mason tract," opened in 1875, and called the "Bancroft Mine." In 1876, when he visited it, they were about to put in operation a "Lightning Pulverizer," or quartz mill, and the "Lightning Amalgamator." He describes the former, and says the inventors claim a capacity of 15 to 30 tons per day, depending on the character of the ore. Professor Stowe saw the machine operated, and was much pleased with the result. The ore, he says, was rapidly reduced to a very fine powder. "In comparison with an ordinary ten-stamp mill this one is cheap, its cost being but \$500, and it requires from six to eight horse-power only to run it." He also describes the "Amalgamator," and says "should this process prove a success at the 'Bancroft Mine,' it will at once create a revolution in gold-mining in the South, as well as elsewhere. Low-grade ores can be worked at a profit, where with any other method they would not pay expenses." This machinery is the invention of Walker Brothers & Co., of Philadelphia. What has been the subsequent success of the "pulverizer" and "amalgamator," we are not advised.

Gold was discovered in Virginia in 1831, and was confined for a considerable period to "surface" mining, corresponding to the "placer" mining of California, and the "gulch" mining of Colorado. It has been pursued with varying success. We have pointed out some of the sources of want of success, and adduced facts sufficient, we think, to demonstrate that Virginia is rich in gold, and that time and perseverance, with improved methods and improved machinery, will make gold-mining here very profitable, and eventuate in making this State one of the most productive gold regions in the world.

We give here Dr. Gray's letter referred to, formerly published in the "Monthly Bulletin." Knowing that Dr. Wm. B. Gray, of Richmond, was familiar with this subject, I requested his assistance, and he kindly furnished me with the following interesting article. While preparing other information for Mr. Lock's book, I thought it advisable to publish Dr. Gray's letter for the benefit of our people before sending it abroad. I may add here, that my investigations induce me to believe that gold-mining in Virginia would be more profitable and would introduce capital into the State if properly conducted. The great defect seems to have been the want of deep mining and a more efficacious mode of separating the gold. The most permanently profitable mining in California has been at considerable depths. Our deepest mines have not reached 150 feet, while in California they have been carried to 1,000 to 1,400 feet. The bane of our mines has been speculation. Gold is found, specimens collected, and sent or carried to the Northern cities, companies formed, and just enough mining done to make an exhibit, and then to sell to another party. People here do not have to "work for their living" as they do in California, and prefer to make money by speculating. There seems to be no doubt but that much of the gold, perhaps most of it, lies in "true fissures," or veins, and not in pockets as some have asserted.

RICHMOND VA., May 18, 1881.

DR. THOMAS POLLARD, *Commissioner of Agriculture, Richmond, Va. :*

Dear Sir : In reply to your inquiries in regard to gold-mining in Virginia in the interest of Alfred G. Lock, F. R. G. S., I respectfully submit—

1st. I am not a practical gold-miner, though acquainted with many facts pertinent thereto, having been raised within two and a-half miles of the oldest gold mine in the State.

2d. Being more familiar with this mine than any other, I give fuller account thereof, compiling my statements from written affidavits from owners and lessees respectively, since the discovery of the mine.

3d. The name of the mine alluded to is "*The Tellurium Gold Mine.*"

4th. It comprises 344 acres of land by late survey. About 320 acres are situated in the county of Fluvanna and 24 acres in the county of Goochland. It is about five miles from the James river at Columbia, on the Richmond and Alleghany railroad.

5th. This mine was discovered by George Fisher, Sr., (now dead) about the year 1832; was leased by him, his sons, and Judge D. W. K. Bowles in 1834, and worked continuously and profitably until 1848, when it was sold to Com. R. F. Stockton.

6th. George Fisher, Jr., now the oldest geologist (practical) in Virginia, states in writing (before me) that there are three developed gold-bearing veins on this property, viz : the big (sandstone), the little, and the middle veins. They run northeast and southwest, and dip at an angle of 20 to 30 degrees east. The average value of the ores for these fourteen years is put down at \$100 per ton, the minimum being about \$5, and the maximum \$300 per ton. The vein matrix carrying gold is slate, quartz, oxide iron (brown), tellurium, etc. ; sulphurets exist in abundance, but not to any considerable extent in the three veins spoken of.

7th. The average estimate of Com. Stockton's work (for nine years) is put at about \$20 per ton by his underground manager. He worked the sandstone vein almost exclusively, while his predecessors operated the two others.

8th. The deepest shaft on the place is 120 feet, and there is only one of these. Of the remainder, 80 or 90 per cent. will not reach an average depth of 45 feet, (water level).

9th. The property, until lately, has been idle ; but is now leased (by its owners "The Columbia Gold-Mining Company," Hon. A. M. Kelley, president,) to a northern gentleman, for purposes of further development, with partial working of its ores. The last report we had, some three months since, represented that he was saving \$7 per ton from the ore furnished by the sandstone vein.

10th. Amalgamation has been the plan of saving the gold in Virginia, and is still, generally, but I understand chlorination is being tried upon the Snead mine in Fluvanna.

11th. A ten stamp California mill is in use upon Tellurium, with amalgamated copper plates to save the gold. I believe this plan will lose at least 40 per cent. of the precious metal. Much of the gold in Virginia is very fine *and cannot be saved by amalgamation*. Wet crushing is used generally. What we want is a better *saving process* than yet known to me, unless chlorination shall serve that purpose. To my mind its chief objection is that it is expensive. I should also advocate dry crushing. Upon a good many properties the gold is lamelated, and

so thin and delicate that it will be readily carried off by water. To illustrate how readily this occurs with the fine gold in the tellurium ore, I will cite a single example : Prof. H. M. Stowe, of Washington, D. C., assayed some of the tellurium ore as follows, viz : the ore was crushed and passed through a sieve, 60 holes per inch, was then agitated in water and allowed 30 seconds to settle, the water was then poured off, filtered, rinsed, dried, and assayed, and gave in gold \$38.98. The aggregate of this, together with the gold which subsided, made the ore worth \$88.06.

12TH.—VALUE OF VIRGINIA GOLD ORES.

Assay of 50 tons Tellurium ore gave an average of \$51.22 per ton, the highest being \$137.50 and the lowest \$7.80. The best information I can give of the general value of the gold ores in Virginia is to say that the average is somewhere between \$5 and \$15 per ton. The ores are abundant, and I have no recollection of seeing any from one of our acknowledged gold mines run under \$4 per ton.

13TH.—COST OF GOLD-MINING AND MILLING IN VIRGINIA.

I am indebted to Prof. Stowe for the itemized cost of mining and milling in Virginia, which statement he has made up by a carefully kept record upon the Ellis gold mine in Virginia. He concludes his paper in these words : "Total of mining and milling at the Ellis may be put at, per ton, \$2.20."

14th. "The Virginia Burke Rocker," about which you inquire, is a mere cradle like a closed infant's cradle, made water-tight, open at the top and provided with a perforated sheet-iron bottom (false and above the true bottom), and a chamber below, charged with mercury for purposes of amalgamation. The whole is placed upon rockers for agitation of gravel, etc., with water, which is constantly kept pouring upon it. It is a rude fixture, but very popular in Virginia for placer miners, or "surface" washers.

Very respectfully submitted.

WILLIAM B. GRAY.

CULTIVATION OF THE GRASSES AND FORAGE PLANTS FOR VIRGINIA.

We may very appropriately introduce this subject by quoting the old proverb, for each line contains a truth, and the three constitute the key to successful farming :

" No grass, no cattle ;
No cattle, no manure ;
No manure, no grass."

The farmer can study no subject more important to his interests than this, being so closely connected with the raising of stock and the improvement of his lands, besides having connected with it the pleasure of seeing his stock abundantly fed, and the satisfaction of having his table supplied with good meats. And beyond this, no crop pays better on the market than Hay, and it is doubtful if any, on a large scale, pays as well. And above all this, while most crops are deteriorating land, it is steadily improving under the culture of the grasses. We say the farmers should study this subject, for there are few who have not something yet to

learn concerning it, and there are many who do not comprehend its importance. What has been written on it in books, in essays, and in articles in Agricultural journals should be read, the experience of neighboring farmers should be sought for, and observation should be made of their mode of cultivation of the grasses most suited to the climate and latitude, and of the successes and failures which attend different modes of management, with times of seeding, quantity per acre of seed, modes of curing and feeding value of different hays.

It is not very much to be wondered at that many Virginia farmers are not well informed on this subject, and not alive to its importance. For many years tobacco, corn, and wheat have been their moneyed crops, and grasses for the two first was an enemy, and not to be encouraged. Of late years, the importance of a clover fallow for wheat has been acknowledged and acted upon by the best farmers, but the writer can remember when clover was unknown and uncultivated, at least in the section around Richmond, and when wheat followed corn in rotation, and even now it is not unusual to see wheat seeded after corn. We remember an old farmer who adhered to old things, and old customs, and everything old, including his politics, priding himself with being an "old Federalist." He was induced by some of his neighbors, or by something he had heard, to try clover. After a year or two from a bad stand, and coarse weeds, we suppose getting possession of much of the field, he concluded that clover was not "federal" (a term he applied to everything he considered good), was injuring his land, and was not to be tolerated. After clover became somewhat established in popular estimation, gradually came Timothy, Herds Grass (Red Top and Orohard Grass).

Another obstacle to the introduction of clover and the grasses into more general use was the prevalent idea, for a long time entertained among farmers, that it was cheaper to wear out land and clear up new lands than to improve them, very much on the principle of a farmer we once knew, who contended, when twitted about keeping such poor mules, that it was cheaper to buy them every few years than to feed them, and he acted to a considerable extent upon this doctrine. But times have changed, and farmers have not the money now to pay hands for clearing up "new grounds" and for buying mules every few years. They must now take care of their lands and their mules, and feed both, or they will all go down the hill together. The farmer's land, which in most cases is all his capital, is more or less worn, and it is only in exceptional cases that he can make tobacco, and corn, and wheat profitable. He must look to other resources, and inquire into some other method by which to turn his land to valuable account. And this is particularly demanded in view of the extensive and cheap transportation from West to East of grain and tobacco. Eastern farmers can scarcely compete with the West in grains, and not in tobacco, unless it be in the "Fancy Brights," and the "Burley" Tobacco of the West seems in a measure to be competing with these. Mr. Edward Atkinson, of Boston, the great statistician and expounder of railroad economies, says this cheap production of grain, and probably Tobacco in the West, is to be no disadvantage to the East, and thus far has been an advantage, by furnishing cheap supplies to the New England States by inducing them to go into more profitable industries; that the lands of Massachusetts and New York have enhanced in value under these influences; and that these States are substituting grass, raising stock, dairying, apples, and other fruits for grain production, and to their manifest advantage. Virginia must do likewise. In Mr. Atkinson's view, cheap grain will be an advantage to the Eastern farmer, in that

they may feed their labor cheaply, and may employ that labor in more productive pursuits, furnished as they are with ready markets for stock, hay and dairy products, fruits, including Grapes and Wine, for which latter Virginia has great advantage. In the writer's opinion, we are already making better Clarets than the French. Hay being a bulky article, the Western cannot drive from the markets Eastern hay. So of stock; we can compete successfully with the West in stock-raising, on account of the cost of transportation, and the injury to stock from crowding on cars. From many points in Virginia lambs can be placed on the New York markets in twenty-four hours, and less.

Our lands in most of Virginia are depressed in price, and do not bring as much in market as before the war, and they will continue to be low as long as we attempt to compete with the West in grain and in heavy tobaccos. But our lands were low in Middle and Tidewater before the war, and that depression in price, let it be noted, has occurred in lands devoted to tobacco and the grains exclusively, all of which require a large amount of labor. In Piedmont and the Valley, where stock-raising and a mixed husbandry are pursued, lands bear an excellent price, and such is the history of the price of lands the world over. A farmer in eastern Virginia owning a farm of five hundred or one thousand acres is generally a poor man. He cannot sell it usually for more than \$10 per acre, and then it must have good improvements. If we look to the North, we find such land selling for \$50 to \$200 per acre, and in England, or France, or Holland, it would command \$400 to \$500 per acre, and what is the cause of this difference? Our climate is better than theirs—our land not naturally inferior, and theirs only made better by grass, sheep and stock raising, and better management. The prices of their products are not better than ours, and on an average not so good. Their taxes are heavier than ours, in Europe greatly more so, if we include the rent of the lands. Their range of products much less in Europe, and even less in the North than ours, for we can raise everything in Virginia that can be raised anywhere in the temperate zone. Our labor is not more than half the cost of that of the Northern States, and while that in England is cheaper than ours, the difference is made up by church and poor rates and other burdens borne by the laborer of England. If all these things mentioned are in our favor, why is it that their lands are so much more valuable than ours. It is accounted for by facts connected with the subject we are considering. *In this country and in Europe land sells highest where grass and the forage plants are raised.* While our lands in Middle and Tidewater Virginia are selling at \$10 per acre (lands of really good quality with improvements), in England and in Holland their best grass lands command as much as \$1,000 per acre. Holland, as it has been my good fortune to see, is almost one continuous plateau of meadow pastured on by fat cattle, which are kept within the owner's bounds by canals of water deep enough and wide enough to prevent their passage. Few laborers are seen and scarcely any needed, but to drive these cattle forth from their stalls in the morning and back in the evening. In Belgium, as in Holland, much land is devoted to grass, and on a farm of 100 acres in grass the steady force is not more than two hands, extra labor being required for grain and hay harvest. In Holland, grain is little raised, and the number of laborers required is very small. Extensive grass culture in a country is a sure evidence of improved Agriculture. Where grass is largely raised we will find a large number of stock, horses, sheep, cattle and hogs, and these produce a large quantity of manure, and where there is abundance of manure there will be large crops of grain and hay, and the

lands are necessarily valuable and will increase in value. Besides the manure made from stock, we must take into account the great improvement effected on land by turning under sod of good grass and clover; it is equal in value to a full application of putrescent manures or the best commercial fertilizers. In "A Manual the Cultivation of the Grasses by C. W. Howard" (Atlanta, Ga., 1881), an illustration is given of the improvement produced by turning under sod land, and also the profits of grazing. In this case it was "Bermuda Grass," of which we shall presently have more to say. Col. Lane, in a letter to Mr. Howard, says: "nearly thirty years ago I bought an old plantation near my place in Hancock county, Georgia. It was bought low, because *infested* with Bermuda Grass. I permitted a man to use thirty acres, which were fully set in this grass. He had at this time a cow and calf, sow and pigs, and a brood mare. He cultivated a little crop of corn, but never enough to feed his family. His stock lived on this thirty acres of Bermuda Grass, except for a short time during the winter, when they had access to other parts of the plantation. He remained on this place five or six years. At the end of that time he had twenty-five head of cattle, seventy-five hogs and five horses. I offered him \$1,000 for his increase in stock, which he refused. So much for the grazing value of Bermuda Grass. I cannot give you a better illustration of the *manurial* value of this grass than by reference to the crops made on this same thirty acres of land after the man had left the place:

"First crop—cotton, half stand, owing to the mass of undecomposed sod, 1,800 pounds of seed cotton per acre.

"Second crop—2,800 pounds of seed cotton per acre.

"Third crop—corn, 65 bushels per acre; corn manured with cotton seed.

"Fourth crop—wheat, 42 bushels per acre.

"The average product of this land without the sod would not have been more than 100 pounds of seed cotton, 15 to 20 bushels corn, and eight to ten bushels wheat per acre."

This is a very remarkable increase in the production of land, due almost entirely to grass. When in corn, cotton seed were applied, which seems to have been all the artificial aid the land had.

VALUE OF THE HAY CROP.

Very few are aware of the amount of hay produced in the United States and its money value, not to speak of what is grown in other parts of the world. Cotton, Tobacco and Tea are confined to localities, while hay is produced the world over, being necessary wherever stock is raised. The hay crop in the United States is estimated at at least three hundred millions of dollars.

But cured grasses (hay) is but a portion of the grass crop, a great amount being fed off in pasturage. The live stock in the United States is estimated at ——. All of this, except hogs, was fed off the Hay and Grass for that year. (We have not yet obtained the Census returns of stock and Hay for 1880.)

SUITABILITY OF VIRGINIA FOR GRASSES AND FORAGE PLANTS— NATIVE GRASSES.

Some portions of Virginia are better suited than others for the grasses. The Piedmont, Valley and Mountain regions are *par excellence* the grass regions of the State, and there is no section in the United States where the grasses are more pro-

ductive, when properly cultivated and managed. But in all portions of Virginia the artificial grasses do well, unless on a few of the most sandy lands; and the forage plants, particularly Fodder-corn, Rye, Sorghum and Lucerne, succeed in all parts of the State, except the latter will not thrive so well in the colder sections. Besides these, the Field Pea grows well everywhere, and makes good hay, or good green material for "Ensilage." The Vetch (pretty much the same as Partridge Pea), and Rape or Caleseed, the Colza of France, and the same as our Spring Kale, also flourish wherever cultivated. The Vetch is considered very justly as a nuisance where wheat is grown, but sowed to itself, it makes a good, productive, hardy forage-plant, and if cut before the seed is matured it ceases to be propagated by the seed. In some portions of the South, South Carolina particularly, it is used for turning under for improvement of the land after grazing it during the winter. We have seen as good clover grown on the lands in Tidewater and Middle Virginia, where the land had been well improved as anywhere. The Herds Grass (Red Top of the North) thrives well in all Eastern Virginia, particularly on swamp, damp lands. And for forage plants Corn and Rye for soilage or for Ensilage, no soils or climate surpass Middle and Tidewater. These sections possess Native grasses, notably Wire Grass and Crabb Grass, of much value, and in the counties on the Bay shore and on the Eastern Shore the "Magothy Bay" bean comes up after grain crops, and seems an excellent improver of lands. Our "Wire Grass," which is the same as the "Bermuda Grass" of the South, as we shall presently show, while it is a great pest in some respects, is a good renovator of lands, and useful for grazing much of the year. We have been told of a farmer in one of the Tidewater counties, who one winter was short of provender; he had a field well set in wire grass, and every few days he would carry his teams to this field, plow up and drag up a load or two of wire grass and feed his stock on it, and repeat the process as he needed the feed. Hogs are very fond of the roots of wire grass, and analysis and practical tests prove this grass to have much nutritive value. Following this example, I tried the same thing last winter and found it answered a very good purpose, particularly if the wire grass was soaked in barrels of water the over night so as to get the dirt off the roots. The Bermuda Grass is greatly prized in the Southern States for grazing and hay, two crops being frequently cut there in one season, and for its being an excellent improver of lands. Some years ago, having inquiries made about Bermuda Grass and the practicability of growing it in Virginia, I wrote to Alabama and procured some of it and planted it in my garden. In the summer I took some of it and some Wire Grass and sent them to Prof. Riley, Botanist to the United States Agricultural Department. He pronounced them the same, viz., "*Cynodon Dactylon*." This plant being a tropical plant imported from the West Indies, grows up in the Southern States as it does not here and makes good hay for mowing. The "Crab Grass" comes up spontaneously after corn and in fields not occupied by anything else. It and Wire Grass are unknown at the North, and they have no fall grasses corresponding to crab grass. While our cattle are feeding on "Crab Grass," at the North they are feeding their hay or grazing their meadows. Crab Grass, while it does not make a strong hay, makes a palatable one, well relished by stock, and is frequently cut, where there is any anticipation of shortness of winter feed. Broom sedge in Virginia affords good early grazing for cattle, though it is objectionable for permanent pastures. In the Piedmont and Valley sections of the State, "Blue Grass," very similar to Kentucky Blue Grass, grows spontaneously.

Every one knows the great value of Blue Grass and its great nutritive and fattening properties. Where Blue Grass grows, fine cattle may be looked for, and it is this which has made the beef of Kentucky so famous in the best markets in the United States, and no doubt it will become well recognized, if it is not already so, in the English markets. The mountain regions of Virginia are filled with nutritive grasses and edible plants, which make stock fat. Farmers owning farms at the foot of the mountains drive their cattle into the mountain regions, go up to salt and look after them every week or ten days, and in the fall they drive them back fat and fit for the butcher. The facility of fattening cattle in these portions of Virginia has been making profitable the recent trade in cattle to England. The prevalence of "Pleuro Pneumonia" in some of the Northern and New England States has caused restrictions to be put by England on cattle trade between the United States and that country—among others, the requiring all cattle to be immediately slaughtered where landed. Recently, the Agricultural Department of the United States has been making enquiries of the Governors of the different States with regard to the prevalence of this disease in their respective States. The communication to the Governor of Virginia was referred to me for investigation and report. I immediately addressed letters to many prominent cattle breeders in Virginia, making enquiries on this subject. More than a dozen replies assured me there was now no such disease prevailing in Virginia. The disease had at one time prevailed in a limited district around Alexandria city, but Col. Johnston in whose dairy it had existed, stated to me by letter that no case has occurred in his herd since December last, and that, as far as he knew, the disease did not exist at all in Virginia. Our climate, while it sometimes, with its hot suns, kills out young clover and checks the second growth of hay, possesses great advantages in curing it. We know nothing of the care the English people have to take in curing their hay and the losses they sustain. It is literally true there that "we must make hay while the sun shines." Our hay crop is not often injured, the first and main one, by hot suns and drought, because it has matured before the very hot suns and droughts prevail, and the suns come just in time to cure it.

There are some *drawbacks* to the growth of the grasses in Virginia. One is the opinion that has prevailed with some that they could not be grown successfully in Middle and Tidewater Virginia; later experience proves this is not so. Should we fail to get a "stand" in clover and the grasses, we have the Wire Grass, and Crab Grass, and various forage plants to fall back upon. We do not often fail to get a stand, if proper steps are taken to secure one, though we sometimes do in very dry seasons like the present, and this is one of the drawbacks. Even in such a season as the present I have a good stand of clover, and that is because the land is in fine order, wheat having followed tobacco which was well manured. On really good land, or where it has been fertilized with a good fertilizer, or where it has had a dressing of stable manure, we are almost certain to get a good stand of clover and the grasses. We shall hereafter speak of the best mode of getting this stand. Another drawback consists in our long, hot summers, with frequent drought, which sometimes kills the young clover where we considered we had a good stand, after wheat or oats. To obviate this, sowing clover and grass seeds by themselves last of August or first of September is often successful. When seeded with grain, that takes much of the nutriment from the tender rootlets of the clover, and when the wheat or oats are cut off, the hot sun frequently comes down with destructive force on the young plants, which are unable to withstand

it, particularly if accompanied with dry weather. At the same time these hot suns, in contrast with dripping weather of England, are a great advantage to us in enabling us to cure hay properly and without loss.

In some parts of Virginia, particularly in portions of Middle and Tidewater, Wire Grass and Broomsedge frequently take possession of clover fields and permanent meadows and pastures of cultivated grasses. The only remedy against the former is to plow up the clover after it has stood two years. For the Broomsedge, if a flock of sheep are closely penned on it by moveable fences, they will kill it by trampling, and by their manure. It is said that Broomsedge only grows on land deficient in Ammonia, which the droppings of the sheep furnish, and that a shovel full of wet or recent manure, or even well-rotted manure, if powdered, be thrown on each tassock of Broomsedge, it will be destroyed. Thick sowing of grasses also tend to crowd out and keep out Broomsedge, which usually comes up in unoccupied places in the field. If grass fields and meadows are well manured it is found that they are rarely troubled with Broomsedge.

RED CLOVER—(*Trifolium Pratense*).

This may be considered the most valuable hay-producing and land-improving plant we have. It is not classed as a grass, but as one of the Leguminosæ, which gather much of the Ammonia from the atmosphere—hence it will thrive on land not rich enough to produce Lucerne and Timothy successfully. The generic name *Trifolium* or *Trefoil* is from the Latin *Tres*, three, and *folium*, a leaf, and the Genus is generally thus easily distinguished by its three leaflets. Red Clover makes excellent hay, bears grazing well, and thrives on land of moderate fertility. No other growth surpasses it in ameliorating lands, and after a farmer gets his land so that it will bring Clover it is in the certain road to improvement, if judiciously managed. Lime is an important element in land for production of clover. A strong evidence of this is that clover succeeds well on all lands which nature has provided with lime. This is exemplified in England, so much of which country is embedded on lime, in Piedmont, and the Valley and Mountain regions, in the Limestone region of Kentucky, and other States. In Tidewater, farmers who have used Marl or Lime have found Clover to be very apt to take on such land, when on similar land, without marl, there is no show for clover. The writer once owned a poor farm in Tidewater, on which there was a fine, accessible bank of marl (about 75 per cent. carbonate lime). Most of it was standing in second growth of pine. Some of this would be cut down each year in the winter, the small limbs with their leaves (pine-tags), would be suffered to lie all the summer, and fall off gradually, and in the succeeding fall or winter this would be cleared up and marled, and put in wheat in the fall or oats in the spring, with clover seeded in February or March on it, and it rarely failed to take in clover. Such is the experience of farmers in Tidewater and Middle Virginia, who have used marl or lime judiciously. The reason of this is that lime enters largely into the composition of clover, and that lime is a great decomposer of vegetable matter, making it available to plant nutrition. Professor Way, Chemist to the Royal Agricultural Society of England, found 35.39 per cent. of the ash of clover (inorganic elements) to be lime, and Bousingault made it 32.80, and practical observation has led to the same conclusion, as the term "clover soils" are found to be tenacious loams, containing more of lime and clay in their com-

position, and the regular limestone lands, as just mentioned. While there is no doubt but what stiff clay and chocolate soils are the regular clover lands, at the same time any rich land, unless very sandy, will bear good clover, and gray soils, if resting on clay subsoils, by deep ploughing and turning up some of the clay, or by use of the subsoil plow, may be made to bring heavy crops of clover. Generally, a good wheat soil is a good clover soil; the richer the soil the better the clover. It is useless to sow clover on poor land without some manure of some kind, and land which will not bring ten to fifteen bushels of wheat should not be put in clover. It will not thrive on wet lands, but will on low lands, if well drained. The land should be ploughed deep as practicable to admit the long tap-root well into the soil, to avoid the danger of being killed by drought, as it can then well pump up moisture from the subsoil.

This plant is of such great importance for hay, and grazing, and improvement of lands, that all causes of failure in its cultivation should, as far as possible, be avoided. It is said that the introduction of clover into England marked an era in the progress of her agriculture, and effected a revolution in this respect, and it is strange that for so long a time it was unknown to our forefathers and unused by them. During this time improvement of land was not attempted, except by putrescent manures, very limited in quantity, and frequently so exposed to the weather and leached, that their effects were soon gone. Those were the days when fields were turned out to grow up in pines or other growth, and fresh lands were cleared to maintain production enough for whites, and blacks, and stock. Clover is very properly regarded as a great improver of soils; its long tap-roots act mechanically and chemically, by loosening the soil and admitting air and light into it and fixing important gases in the earth to enrich it—by shading the ground with its foliage, which falling furnish Ammonia to the soil, while the roots decayidg do the same thing, and add largely to the black matter which we call soil. At the same time clover, when a good growth, keeps down and smothers noxious weeds. Clover is much relished by all stock, and makes a rich, nutritious hay. An analysis of it will be found in a table on a subsequent page.

Clover is usually seeded in the spring on wheat, or on oats, or rye. Some seed in the fall, last of August or first of September, either alone or with rye, which is found by its hugging closely the ground and protecting the clover to be a very favorable grain to sow it with. It is not a very easy thing to get a "stand" of clover. In the spring of 1880 I sent out a circular to many good farmers in the different counties of the State, asking a statement of their experience and practice in the management of the different crops. Among others was the inquiry about the best mode of getting a "stand" of clover. Many replies were received. The majority favored sowing on wheat early in the spring, and using the drag to get the seed in—some dragging, then sowing and running the drag again, some preferring the roller, or both—some dragging, and sowing without dragging, and some sowing and then only dragging. No doubt the safest way is to drag, then sow, redrag, and then rolling. Several say sow clover *alone*, on land well prepared, in April or early in September. In this way Mr. Jas. M. Newman, of Buckingham, says he never fails to get a stand. Mr. G. F. Hopkins, of Rockingham, says "the usual mode of seeding on small grain early in spring and harrowing amounts to about one 'catch' to one 'failure' (and this in a fine grass country); to sow in August, on corn or on small grain (one to one and a-half gallons per acre) is the best chance." Several prominent farmers

say that of late years the failure of a 'catch' has been very frequent, and one Orange farmer, considered very successful in agriculture, said "my failures have been so frequent I have nothing to offer on the subject."

There is no doubt but what sowing clover and the grasses without small grain offers the best chance of success. Then sowing one gallon in the fall, say September and last of August, and another early in the spring, will give a double chance of a "catch." There is considerable danger of clover being killed out in the summer after small grain is cut, which leaves the tender grass which has been shaded to the mercy of the hot suns, and while the grain is growing rapidly in the spring and early summer, its thousand rootlets are constantly pumping up water and the nutriment of the ground and abstracting it from the clover. If a "stand" is secured, and the "hog," or "rag" weed comes up luxuriantly, it is well last of August and September to cut it off, for it is taking nutriment from the clover and shading it too much. Where this is done we have always noticed that the clover that fall grew off rapidly, and the next season made a better crop. Many farmers object to sowing clover without grain, saying they cannot spare the ground. But a good clover crop is worth more than a wheat crop, and if a "catch" fails, then the ground must be put in wheat again, or in something else, and the clover crop is thrown back one year, or perhaps longer, by another failure. Then if a "stand" is obtained in August or September, the clover will grow so much better when alone that a crop may be cut the next season, whereas we generally get no crop until the second summer. Where rye is raised for soiling, and it will always pay well to raise a certain amount for this purpose, for feeding cows, horses, and hogs, and clover is seeded on the rye in August or September, a "stand" is very apt to be secured, and the rye being cut off in April, the clover gets a good start before the hot suns appear, and, as before remarked, rye is the best protector for the clover in the winter. We have succeeded in getting an excellent "catch" of clover, seeded last of August on winter oats, which had just been seeded among the standing corn. The corn shades the clover, makes it come up sooner, and by the time the corn is matured and ceases to draw the land, the clover has become well established and prepared to stand the winter. Every one knows how much more apt we are to get a "stand" on good than on indifferent land, and has noticed how certain clover is to take where the land has been top-dressed with stable manure. We sometimes see a good "stand" where fields or spots have been top-dressed with stable manure, made from horses which have been fed on clover. And we think it would be a good plan to preserve such manure to top-dress the more indifferent portions of wheat fields which are to be seeded to clover in the spring.

QUANTITY OF SEED PER ACRE.

One gallon of clover seed per acre is the old rule. But it is not a safe rule, unless other grass is to be seeded with it. When alone we would not sow less than one and a-half gallons, and would prefer two gallons to one. One of our correspondents says he sows as much as he thinks necessary, and then goes over and sows half as much again. Last spring we seeded rather more than one and a-half gallons per acre, and see the good effects. We notice a considerable portion killed out, but still there is enough remaining to make a good crop.

If Clover is seeded with Oats in the spring, we think it is safer to run a brush over it than to trust to its being gotten into the land by rain, which may be de-

laid. It comes up sooner by the brushing. Clover thus seeded, in our experience, is very apt to make a good stand. And here we are reminded to remark that it is not at all wonderful that clover so frequently fails to take when seeded on wheat in the spring. The ground has been baking, and running together and hardening all the winter, and where is the seed bed for such small seeds. Who would expect to see Turnips, or Beets, or Garden Peas, succeed on such prepared land, to thrive, and grow, and bear crops. We should rather expect to see them die out soon after vegetating. Sowing clover on ground expressly prepared for it in the fall or spring, obviates this difficulty, for here we have a seed-bed ready to receive the small seeds, and after they have vegetated, soft, deep, well pulverized soil to permit the rootlets to spread in it, take deep hold, and live in spite of hot suns and drouths.

CUTTING AND CURING.

The difficulty of curing Clover Hay is one of the drawbacks to its cultivation, though this may very generally be accomplished if it is properly managed. We have heard farmers say they could cut Clover in the morning and house it safely the same evening, and I have no doubt they were correct. I cut some this year and housed it sometime before night, because it was dried up by the drouth, and might have been housed in two hours after cutting. Hay, too, on light thin lands even without drouth, may be housed the same day, if well handled. But a heavy growth of clover from good, strong, heavy clay lands, requires three or four days of clear weather to cure it ready for housing, and particularly if cut at the proper time, just as the heads *begin* to turn brown. Clover that is cut in the morning may be put in the "Cocks" in the evening, particularly if subjected to the use of the "Tedder." If the clover is heavy, with much sap, it is best to open it the next day for awhile, then put up again to remain until cured enough to put under shelter, which will be in a few days; but before this is done it should be opened for a few hours, unless it is well cured. Clover hay, and all hay indeed, should be cured as much as practicable in the shade, and not subjected to hot, drying sun more than necessary.

In *very heavy* Clover Hay, the best plan is to get long stakes, six to eight feet long after they are let in the ground, which is done by means of a crowbar. Around these the Hay is shocked the evening of the morning it is cut, but in doing this it is well to raise the hay from the ground by running another stick under the cock and supporting the end of that by a short upright stick like the trigger to a patridge trap. Heavy Clover, cut when the plant is full of sap, is not easy to cure, and should not be put under shelter while there is danger of its heating. We have seen this occur three or four days after cutting. In that time, however, it may be put under shelter if the weather has been good and the plan of the stakes just proposed is carried out, but before housing it should be exposed from one to two or three hours to the sun and air, a less time when the sun is very hot. Endeavor to handle it as much as possible when the leaves are not dry enough to shatter. The plan of putting salt on it while packing away we do not believe has any effect in preserving it. The deliquescent property of salt (condensing moisture from the atmosphere) may have the contrary effect. Air-slacked lime we have no doubt helps to keep it sound, but this must be more or less disagreeable to stock, and may generally be dispensed with.

Good land in a favorable season, if the clover is well set, will yield two tons per acre, sometimes more, when very rich. One year the writer, on a piece of land

of twenty-five acres, owned conjointly by himself and another farmer, realized \$610, after losing nearly one-fourth by bad rickling, and after putting out about a fourth or fifth of the land to be cut and cured one half for the other. On the third crop from the same land, the next year, we realized \$710. Clover is not usually suffered to stand more than two years, as some dies out and other is superseded by weeds and coarse grasses. In Eastern Virginia wire grass the third year will frequently have taken possession of half the field. In other fields broom sedge will be almost as interfering.

Clover is so generally raised now, though not as much so as it should be, that every farmer should endeavor to raise his own seed as they sell so high, and out of proportion to the cost of saving. The second crop is reserved for seed, and a simple implement, which is generally made on the farm, consisting of a box running on wheels with fingers for collecting the heads of clover, is used, with one horse attached. The cocks of seed are suffered to remain in the field until the heads containing them are somewhat rotted, so as to give up the seed, and they are then cleaned out. Or the heads may be cut with a grass blade and treated in the same way. In the more strictly grass portions of the State the seed are much saved for market, and pay very well (\$25 to \$30 per acre), after getting off too, the first crop of hay.

Care should be taken in not *pasturing* clover too early in the spring; the temptation is very strong to turn cattle, and horses, and hogs on it, as it puts out early and stock are very hungry for it. Of course, if intended to be cut they should not be turned on until the second crop, and even then the clover may be killed if pastured too long in the hot suns. The same thing may occur if they are turned on before the clover is well in blossom. It is a very desirable feed to have for hogs; they will keep in good order on clover alone. Good land is found to reseed itself, and remain in clover a long time, sometimes even where a hoe crop has intervened.

ORCHARD GRASS—(*Dactylis Glomerata*).

This is a valuable grass, and is highly esteemed by those who have raised it, ranking next to clover in the opinion of many, both for hay and pasturage; and for winter pasturage as being superior to any other for Middle and Tidewater, and indeed in Piedmont and the Valley it affords good winter grazing when the snow is off the ground and the winters are not too severe. And it is ready for grazing ten or twelve days earlier than any other grass that affords a good bite.

Orchard grass is common to every country in Europe and portions of Africa and Asia. It was introduced into Virginia in 1764 from England, where it had been cultivated some years previously. It soon became very popular in England, and forms there one of the most common grasses of English natural pastures. It is marked by rapidity of growth, the luxuriance of its aftermath, its endurance of drought and cold, and its power of enduring cropping; these make it particularly valuable as a pasture grass. As a pasture grass it should be fed close to prevent its forming thick, isolated tufts, and to prevent its running to seed when it becomes hard and wiry, losing much of its nutritive value. All stock eat it eagerly when green, but if cut too late for hay after it becomes hard, they do not relish it and eat it indifferently. On this account it should be cut as soon as it begins to blossom. It blossoms earlier than Timothy, and about the same time as clover and tall meadow oat grass, and for this reason orchard grass and the two

latter may well be seeded together, but neither with Timothy. The only objection to sowing clover and orchard grass together is, that the clover dies out pretty much after the second year, whereas orchard grass is not in its prime until the third year, and will usually stand for years. When the clover dies out, it may leave space for the orchard grass to grow in tussocks. A difficulty about a permanent pasture in some portions of eastern Virginia is the great prevalence of wire grass, which is very apt to take possession by the third year. The same difficulty arises in a measure from Broom Sedge, which is said to prevail where there is want of Ammonia in the land. After cutting, Orchard Grass springs up rapidly, and the aftergrowth is good. This should not be pastured during the summer and fall, but be reserved for winter grazing after Christmas; the stock should be turned upon it only in dry weather and be taken off by March 1st, if it is designed for hay; if not, they may be continued on it until other grasses come in. This grass is highly esteemed in the Northern States, but they lose one advantage there which we have here, viz: winter grazing. Judge Buel says of it, "The American Cocks-foot, or Orchard Grass, is one of the most abiding grasses we have. It is probably better adapted than any other grass to sow with clover and other seeds for permanent pasture, or for hay, as it is fit to cut with clover, and grows remarkably quick when cropped by cattle. Five or six days' growth in summer suffices to give a good 'bite.' Its good properties consist in its early and rapid growth, and its resistance of drought; but all agree that it should be closely cropped. Sheep will pass over every other grass to feed upon it. If suffered to grow long, without being cropped, it becomes coarse and harsh (Flint on Grasses). The same author quotes from Col. Powell (a late eminent farmer of Pennsylvania) who after growing it ten years declares that it "produces more pasturage than any other grass he has seen in America. On being fed very close, it has produced good pasturage after remaining five days at rest. It is suited to all arable soils." And from Mr. Sanders, a well-known practical farmer and cattle breeder of Kentucky, who says: "My observation and experience have induced me to rely mainly on Orchard Grass and Red Clover, indeed I now sow no other sort of grass seed. These grasses mixed make the best hay of all the grasses for this climate (Kentucky). It is nutritious and well adapted as food for stock. Orchard grass is ready for grazing in the spring ten or twelve days sooner than any other that affords a full 'bite.' When grazed down and the stock turned off, it will be ready for regrazing in less than half the time required for Kentucky Blue Grass. It stands a severe drought better than any other grass, keeping green and growing when other sorts are dried up. In summer it will grow more in a day than Blue Grass will in a week. Orchard Grass is naturally disposed to form and grow in tussocks. The best preventive is a good preparation of the ground and a sufficiency of seed uniformly sown. The late Judge Peters, of Pennsylvania, who was at the head of agricultural improvement in that State for many years, preferred it to all other grasses." This is strong testimony, coming, as it does, from Kentucky, the "Blue Grass State." Orchard Grass will endure considerable shade, as in orchards and groves thinned out, and is said to be less exhausting than Timothy and some other grasses.

Two bushels of the seed per acre should be sown—it is light, only 12 pounds to the bushel. This when alone, but with clover only one bushel will do, and the same with tall meadow oat grass, or a mixture of one bushel each, when seeded with clover, and the same if only orchard grass and tall meadow oat grass are put

in together. It is well to dampen the seed the over night and separate them well the next morning by mixing in plaster or partially-slacked ashes, thoroughly.

TIMOTHY—(*Phleum Pratense*).

This grass is called at the North, Herds Grass, a name we at the South and the farmers of Pennsylvania give to Red Top (*Agrostis Vulgaris*). The name Timothy is said to have been derived from a Mr. Timothy Hanson, who is reported to have cultivated it extensively, and to have taken the seed from New York to Carolina. Its culture is said to have been introduced into Virginia from England in 1760 or 1761. The name Herds Grass is said to have been given it because a man of that name found it growing wild in New Hampshire more than one hundred and fifty years ago, and who then cultivated it.

It is said that the nutritive value of this hay when ripe exceeds that at the time of flowering; yet if allowed to ripen its seed (which, on a single acre, have sometimes amounted to thirty bushels) the hay is somewhat coarse and hard; if cut in the blossom or directly after, it is much relished by all kinds of stock, especially by horses. It possesses a large amount of nutritive value, compared with other grasses, as will be seen by the analysis of grasses given on a subsequent page. It should not be sown with clover, as it blossoms too late for it, and is now usually sown alone. It thrives best on low lands, of moist, loamy character, and in Virginia is not suited to our high lands, and on this account and its not standing grazing well or close cutting, it is limited in its cultivation in the State. It is not considered a hardy grass, is killed out by much grazing on account of its roots being bulbous and easily destroyed, or too low mowing, and by the hot suns, and of late years has been subject to an insect just before the time of blossoming which causes the stalk to die. Where it succeeds well it is very productive and valuable, as much as four tons per acre being sometimes produced. About 12 pounds of seed are usually sown to the acre.

HERDS GRASS—RED TOP—(*Agrostis Vulgaris*).

This grass is considerably cultivated in Virginia, particularly on the low lands of Tidewater, though it grows well on improved high lands. As before stated, it is known in Pennsylvania and the Southern States as Herds Grass (from its being introduced by a man of that name). It is a good, permanent grass, standing our climate well and well suited to pastures, where it should be fed close, for if allowed to grow up to seed the cattle do not relish it. It should be cut just as the seed begins to ripen, and before the stalk has changed its color. The soil best suited to it is moist, swampy land, and it will grow in almost running water. It is a very popular grass on the Chickahominy river (swampy land) and other low streams in Tidewater. Herds Grass and Timothy may well be sown together, as they are ready for cutting at the same time, and the mixture is heavier than either grass singly. The Timothy will not grow on land as wet as that on which Herds Grass flourishes. A peck of seed is usually sown per acre, though 1½ to 2 pecks is not too much. It is a bad plan to stint the quantity of grass seed sown.

MEADOW-OAT GRASS—(*Archenatherum Avenaceum*).

This grass is sometimes called Tall Meadow Oat Grass because it frequently grows seven feet, tall enough to hide a man. It has the advantage of being a good hay, as well as winter pasture grass; the quantity of winter food yielded by it in the South is said to be greater than any other grass. It requires rich, high land, not succeeding well on moist lands, but will grow on more sandy land than most of the artificial grasses. The quality of the hay is good, and the quantity satisfactory. It comes in well with Orchard Grass, and they are frequently seeded together. It matures rapidly, and seed sown in the spring will mature seed by the fall. The seed shatters easily, but may be saved by cutting off the heads in time with a cradle and tying up as grain, and then the remainder may be cut for hay. The quantity of seed to sow is two bushels per acre if alone, and with Orchard Grass one bushel of each will do, though we think rather more is preferable. We once tried these grasses together; the Tall Meadow Oat Grass did not seem as hardy as the Orchard Grass, of less vigorous growth, and not so lasting as the Orchard Grass. We think it (the Meadow Grass) will succeed on thinner land than most grasses, and is valuable for pasture on account of its early and luxuriant growth and its thick aftermath. After it is cut no stock should be allowed to graze it in summer or fall if expected to be grazed in the winter. This is the "Ray Grass" of France.

LUCERNE—ALFALFA—(*Medicago Saliva*).

This is a leguminous plant of great value where the climate is suitable to its full maturity. It requires a warm climate, one rather warmer than ours, we think. Flint says it was brought from Persia to Greece in the time of Darius, and its cultivation afterwards extended to the Romans, and through them to the south of France, where it has ever since continued to be a popular forage plant. It does not endure a climate as cold as Red Clover, requiring great heat and sunlight; in a climate equally suited to both Clover and Lucerne, it is difficult to say which should have the preference. Howard, who recommends it for Georgia, says, "It is a child of the sun; it is a plant of a warm climate; its long top root renders it comparatively insensible to droughth." Yet, in a letter received some time since from Mr. Crozier, of Long Island, New York, he states to me that he raises it with much success, and relies on it to give richness and color to his butter, which has a wide and just reputation for its excellency. No doubt he gives it very high cultivation on rich land, which it requires, and that the climate is modified by the ocean air by which he is surrounded. It has been frequently tried in Virginia, but has obtained no permanent foothold here. We tried it some years since drilled and cultivated, and it did well until overrun by wire grass. A neighbor tried it for his milk dairy, and thought the milk gave back in quantity and quality while his cows were fed on it. No doubt this was because the plant did not arrive at full maturity. Mr. Howard says great efforts have been made to introduce Lucerne into England, but the soil or climate, or both, are unsuited to it; no doubt mostly the climate, which lacks warm suns. The efforts to cultivate it also in the Northern States of this country have been generally unsuccessful. Mr. Howard recommends it to be drilled on rich land, eighteen inches apart and manured with

well rotted manure, so as to contain no seeds, twelve pounds of seed to the acre. If such manure cannot be had, then to use a Commercial Fertilizer, 1,000 pounds to the acre, with small amount of Ammonia (as it obtains more Ammonia from the atmosphere than any other plant) and a large percentage of Phosphoric Acid and Potash. Others advise it to be seeded broadcast thickly, on very clean land, as it should always be seeded on such land, with the belief that the ground being fully occupied with Lucerne, other grasses would be kept down. The first year particularly it should be left clean, and crab grass and weeds which appear must be repeatedly moved before they seed. Howard says as a forage plant at the South Lucerne is superior to all others; that five tons of excellent hay may be made from one acre, and that one acre will support from fodder, green and dry, five horses for one year; and that domestic animals prefer it to any other hay. We noticed when we raised it that pigs and a colt always when turned out sought Lucerne in preference to Clover. It should however not be grazed by cattle and horses, as they bite out the crowns of the plants and destroy them. Hogs will keep in good order on it if cut and thrown to them. One great advantage of this plant is that it is perennial, and stands droughth remarkably well, and is ready to be cut a month in advance of Red Clover, and may be cut several times a year on rich land. It does not reach perfection until the third year. Two or three crops may be cut yearly on rich land—the first generally used for soiling, the last for Hay. Its nutritive value is rather inferior to Red Clover.

SAINFOIN—(*Hedysarum Onobrychis*).

This is a legumious plant, containing more nutritive matter than Clover or Lucerne, though the amount of forage is less than from either of these. It is considered indispensable in the south of France, in Italy, and about the Mediterranean, where it obtained the Italian name Sainfoin—"holy grass." It is said to grow in very dry soil, with sand and gravel, on account of its long tap root, but it requires a calcareous soil, and does not, when the plants are young, stand a severe winter. Like Lucerne, it is perennial. Its seed have been generally distributed over the country, but it does not seem to have become popular anywhere—and we think it did not generally grow up high enough to cut.

MILLETT.

There are several varieties of Millett cultivated in this country (about eight), but the Common Millett (*Panicum Milaceum*) and the Hungarian or German Millett (*Panicum Germanicum*), of which there are several varieties, are chiefly raised. It is used for soiling purposes, for hay, and for seed, of which fifty bushels to the acre are sometimes raised. When cut to feed green the seed are not matured. When for Hay they are enough matured to make them valuable for feeding, and the Hay is considered very nutritious. The Common Millett matures in sixty days and the German in a little more time, say about seventy or seventy-five. This is one of the manifest advantages of this plant, as it may be seeded on land from which Wheat, and Oats, and Early Vegetables have been removed, and be ready to cut before frost. It requires good land, and probably is exhausting on account of its rapid growth, and particularly where the seeds are matured. It is an annual.

ALSIKE OR SWEDISH CLOVER—(*Trefolium Hybridum*).

This is a perennial, springing like White Clover from the roots; is not so tall as Red Clover; it does not seem to have been successfully cultivated in Virginia, as we are probably too far south for its success, it being a native of Sweden. It is said to continue in the land for many years from its own seeds if left to mature.

CRIMSON CLOVER.

This is sometimes called German or French clover. It has a very handsome bright red (pink) bloom, is seeded last of August by itself, and matures early in spring, sometime before Red Clover, and is fed green. It is a very good soiling plant, and stock are very fond of it.

WHITE CLOVER—(*Trefolium Repens*).

This in Virginia is considered a native, is never seeded because it does not with us, as it does farther South, grow up high enough to cut. On rich land it makes good grazing, much relished by stock.

BLUE GRASS—JUNE GRASS—KENTUCKY BLUE GRASS—(*Poa Pratensis*).

We have omitted to speak of Blue grass—a very important grass. In Kentucky and in other limestone regions it attains its greatest perfection, and while an excellent pasture grass of most decided nutritive character, it does not make a heavy crop of hay, and does not stand hot suns well, getting so dry sometimes as to burn in the field, while it stands the winters well and frequently affords very good winter grazing. The cattle raised on it in Kentucky are of first character, and Kentucky beef has a great reputation in Northern markets, and is found in all the most fashionable menus of the country. This grass is the same as our "Green Sward," found in yards and under walnut and locust trees, but differs in some respects from the Blue grass, which is indigenous to the Piedmont, Valley and Mountain regions of Virginia. The stems are flattened, hence the name *Poa Compressa*; the color is *blueish* green, while the Kentucky Blue grass is of shining green color; the leaves short and hairy. These two kinds of Blue grass do not differ materially in their nutritive value; their habits are much alike; they are both natural grasses, and we suppose for practical purposes may be considered alike; the difference being probably mostly due to difference of locality and soil. The Kentucky Blue grass is said to vary very much in appearance and size, according to the soil on which it grows. It flowers in June, and hence in the Eastern and Northern States is sometimes called June grass. The height is from ten to fifteen inches, the root is perennial and *creeping*, producing but one flowering stem in a year, while many of the other grasses continue to shoot up flower stalks and run to seed during the season. The produce ordinarily is small compared with some other grasses, but the herbage and pasturage are fine. It is considered by some the most valuable of all grasses for pasturing, though it scarcely equals clover, and is surpassed by Timothy and Bermuda Grass in nutritive value, according to analysis. It makes excellent hay, but small in quantity, and is generally used for grazing. If intended for hay it should be cut at the time of flower-

ing, some say just as the seed begins to ripen, as if the seed is allowed to ripen much of the crop is lost. A writer (an Ohio farmer), quoted by Flint, says: "It makes the best of hay. I have used it for twenty years. It should be cut just as the seed *begin* to ripen, be well spread, and protected from dew at night by windrowing or cocking, the second even stacked. * * When properly cured, stock seem greatly to prefer it to all other hay. I would not recommend it for meadow especially, however, because the yield is hardly equal to Timothy and clover, and because it is more difficult to cut and cure." The same writer says, "Any time in the winter when the snow is on the ground, sow broadcast from three to four quarts of clover seed to the acre. With the spring the seeds germinate, and are very fine in the sprouts and delicate. No stock should be allowed for the first year, nor until the grass seeds in June for the first time in the *second* year. The best plan is to turn on the stock when the seed ripens in June, Graze off the grass, then allow fall growth, and graze all winter, taking care never to feed the grass closely at any time." Four quarts per acre is the quantity of seed generally recommended. The plan recommended above may answer well, but we should prefer taking the chance of sowing early in the spring, on wheat, or oats, or rye, as we do clover, or last of August or first of September by itself. With regard to close grazing, Mr. C. H. Howard says, "this grass will bear close grazing, and is not thus injured, as are many other grasses, because it is 'stotoniferous' or runs and spreads from the roots." Another eminent cattle breeder (Flint) says, "whoever has limestone land has Blue grass; whoever has Blue grass has the basis of all agricultural prosperity; and that man, if he has not the finest horses, cattle and sheep, has no one to blame but himself. Others in other circumstances may do well; he can hardly avoid doing well if he will try."

Even though analysis may not show this grass to possess as much nutritive value as Timothy or Bermuda grass or clover in some respects, still the practical tests by grazing prove Blue grass one of the richest grasses, and on no grass does stock seem to thrive more rapidly, and they will grow fat on it when they seem to be biting in the dust to get at it. It does not stand heat well, and grows better where there is some shade. In the summer, if there is drought, it gets very dry, looking as it would burn if set fire to, but under this is concealed the living grass, and if left to have its full growth, will make fine pasture for winter, and its chief value is for winter pasture, when there is not too much snow. Cattle cannot get it through the snow, but sheep, mules and horses will paw off the snow and get enough without any other food when the growth is good. Sometimes it remains green all the summer if the weather is favorable as to moisture, taking a second active growth in August. It makes good woodland pasture, as before remarked bearing shade well, and is particularly valuable for hogs. When oak trees are thinned out and trampled around they scarcely ever fail in their acorns, and hogs are thus fattened at a very small expense.

The Blue grass of the Valley and Piedmont (*Poa Compressa*) is highly esteemed in this section, and on rich land is sometimes very productive, in some instances growing as high as a man's arm-pits. On inquiring of an old farmer, who formerly farmed in this section, why it was not more frequently seeded in this region, he replied that land which had been in wheat, if suffered to stand two years, would become well sodded in the Blue grass of Virginia.

We find a very interesting account of the origin of this remarkable grass (*Poa Pratensis*) and its introduction and spread into Kentucky in the "Shepherd's Na-

tional Journal" (No. 2), extracted from the writings of Colonel Killebrew, Commissioner of Agriculture of Tennessee, which seems to show that it was carried from Virginia to Kentucky, and is an evidence of the similarity of the Virginia and Kentucky Blue Grass, and that the difference now existing has been probably due to change of circumstances, climate, soil, &c. Colonel Killebrew says Dr. F. H. Gordon, of Smyth county (we suppose of Tennessee), spent years in studying the habits of "Blue Grass," and finally succeeded in giving the best instructions for securing a stand. Dr. Gordon says :

"Some seventy years ago (writing in 1871) two young men named Cunningham came from the south branch of the Potomac, in Virginia, to Strode's creek, in Bourbon county, Kentucky. They had studied and practiced the Blue Grass system on the Potomac. They jointly purchased two hundred acres on Strode's creek, and sowed the whole tract in Timothy and Blue grass. In a few years their whole tract was covered with a luxuriant coat of grass. They had brought with them the seed, on a pack horse, all the way from Virginia. Their farm soon attracted the attention of their neighbors, who began to visit and learn how to manage grass. In 1835, I too went to see the Cunninghams, and many other farmers in the Blue-grass region, in order to learn the system. I devoted many weeks to the study of the system—going with the best farmers over their farms and seeing their management, asking many questions and writing down their answers. Then, the Cunninghams, like many others, had grown wealthy on the profits of the Blue Grass. One of them, Robert, then had two thousand acres in Blue Grass, and Isaac had three thousand. Nearly all the farmers I visited owed the luxury of their Blue Grass to the direct instructions of the Cunninghams. To me it was a feast to travel over and view the fine sod of grass on the first two hundred acres which had caused the whole Blue Grass region to become so beautiful, prosperous and wealthy.

"While learning the Blue Grass system, I saw in every neighborhood that those who had studied the system closest had the best pastures invariably. You can see in all that region of Blue Grass some farms where all the lots look like some of ours in Tennessee, which are gnawed all the year round by calves, sheep and geese. This is because the owner does not think enough about its management. He does all the work and incurs all the expense necessary to make the richest pastures, and then wastes it all by bad and thoughtless management. But there are some farmers in almost every county in Tennessee who well understand the Kentucky system. Those who intend to sow grass may learn the system from them. What a scene of comfort, beauty, luxury and wealth will this whole Middle Tennessee present when it shall be covered with the richest Blue Grass! Such will be the future of this fine country." [And why may we not say the same of all Piedmont and Valley, and Mountain regions of Virginia?]

* * * "We now till too much land. We ought to till less and make more grass. Let not an acre be idle. There is our true interest. Cotton, tobacco, rice, hemp and sugar need laborers, but grass does not. If we sow our lands in grass we can do without so much labor. The indisposition of farmers to take advantage of experience is shown in the following case, which is in point :

"I know a rocky lot of about six acres which I myself sowed in 1835. During the year 1870 it afforded a profit to the present owner of full ten dollars per acre. The owner has no grass on the balance of his land, and does not intend to have

any. He has lived during his whole life in sight of rich pastures of blue grass, and knows that his whole tract will produce as good grass as those pastures, yet he will not sow grass. The reader will say that this farmer, with his six rocky acres of blue grass, is a singular man. But he is not very singular, because hundreds of farmers here know just as well the value of blue grass as he does, and yet do not sow it.

* * * "Lime is a natural stimulant to it, and it flourishes best where natural supplies of this salt are found. Lime, though a great stimulant to its growth, is not an essential ingredient in the soil. Blue grass will always grow well under walnut and locust trees."

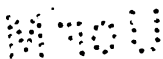
We have in Piedmont and the Valley the same character of soil that exists in the blue grass country of Kentucky.

* * * "Select the lot to be sown, and clean off all brush, leaves and briars. If it cannot be done with a stalk rake, use hand rakes, as the seed must come in contact with the soil. Seed sown on a bed of leaves will soon germinate, but the rootlets, being unable to burrow in the soil, will quickly parch up and die. If the land is thickly covered with trees, it will not thrive well, therefore it is necessary the timber should be thinned out. Leave the tallest trees that are really the more valuable, taking off the low bushy kinds that make too much shade. It is an admitted fact that blue grass does better in partial shade than where there is none. It does not endure a drought as well as some other grasses, and, consequently, some degree of shade is essential to protect it from the scorching rays of midsummer.

"So many seasons have been recommended as the proper time of sowing that it may be said each one under favorable circumstances is a good time. One Kentucky farmer says: 'Any time in the winter, when snow is on the ground, sow broadcast from three to four quarts of seed to the acre. With the spring the seeds germinate, and are very fine and delicate in the sprouts. No stock should be allowed for the first year nor until the grass seeds in June for the first time the second year. The best plan is to turn on the stock when the seeds ripen in June. Graze off the grass, then allow the fall growth, and graze all winter, taking care never to feed the grass closely at any time.'

"Many sow, as stated in the above quotation, on winter snows, and that is a very good plan, but care should be observed to have the ground free from leaves before the snow falls.

"There are others who sow in the latter part of February or first of March, and this sometimes does as well as any, provided time is given for the grass to get sufficient hold to resist the withering effects of the summer's drought. The main care to be taken is to get the grass large enough to live through freezing or dry weather. It will resist the effects of frost better than heat, however, and taking this into consideration, the most approved time of sowing is in the last of August or first of September. If sown at this time the autumnal rains will germinate the seed, and besides, at this season there is comparatively little trash on the ground, the leaves having not yet fallen. The ground being prepared, the seeds are sown broadcast, at the rate of one bushel per acre, and the sower should be followed with a harrow, or, if the ground is very loose, with a stiff brush. This will give them a sufficient covering. It is a fact, demonstrated by actual experiment, that grass seeds will vegetate best at a depth of one quarter of an inch. It may be supposed that, with no more covering than will be given by a harrow or brush, a



great many seeds will be uncovered. This is very true, but in one pound of blue grass seed (clean seed) there are 3,888,000 seeds. By a computation every square inch of surface contains from ten to twelve seeds. With this amount on the surface, one scarcely need fear a stand, when, if one or two take root, there will be in a year an excessively close turf.

"There can be but little difference of opinion in regard to the treading of stock after sowing. All writers and farmers agree that for one year at least, it should be kept from all stock. After that there is some difference.

"Dr. Gordon, who, as before stated, paid more attention to it than any one else in the State, adopted a plan of management that has been repeatedly tested with uniform success. It was this: He sowed, either in the autumn or spring months, indiscriminately, as suited his convenience. He usually sowed with rye, wheat, or barley, if sowed in an open field, but if in a woods lot, he sowed with rye, or after a crop of millet. At any rate, the soil must be well cleaned off and broken up as well as the nature of the land permits, then, after the grain is sown, the land is harrowed, and if possible rolled. After this the grass seeds were sown and brushed lightly. Immediately afterward all the cattle, horses and sheep were turned in that could be secured. If there was not enough on his place, he borrowed his neighbor's stock, and let them run on it until the ground was well packed all over the surface, and then, and not until then, were they removed. If after millet (and that is greatly recommended, as it destroys more effectively than anything else all weeds) harrow about the first of September thoroughly, sow the seed, brush as before, and then turn on the stock. If it is desired to sow in the spring, in the latter part of February or early in March, if not practicable sooner, harrow the grain field, the ground having been well prepared in the fall sowing, sow the seed and then turn stock on the wheat, rye, or barley, as the case may be. Oat land may be sown in the same way. The treading of the stock packs in the seeds and prevents the grass from drying up in the summer heats, or freezing out in frosts. Dr. Gordon considered an open, loose, porous surface to be unfavorable to the safety of the young grass, but if packed as directed, the grass will quickly spring up, get a firm hold, and the loose condition of the subsoil will favor the transmission of the roots to a good depth.

"The after treatment is simple, and that is to allow no stock on during the first year, but as soon as the seed stalks begin to shoot up the next year, pasture it so closely that it cannot go to seed.

"Dr. Gordon differs in this respect from other authors, who allow it to seed one time for purposes stated below. He would not let it seed at all. His great success in this branch of agriculture will, in every place where he is known, give weight to his authority.

"Others say no stock should go on it for at least two years, or at least until after the first seeding, which will take place in June of the second year. Some of the best blue grass lots in Middle Tennessee have been started by following either of the above plans. Of one thing there cannot be a doubt, and that is, the ground should be well broken up. On the surface it should be as firmly packed as possible to secure a perfect stand and form a perfect turf. When the surface is too loose the grass easily dries up, and is much easier frozen out, the seeds not going into a germinating depth. Under favorable weather, seed sown in the spring on a crop of oats will do as well as fall sowing. What is meant by favorable weather is that no unusual dry weather supervenes. But there is always the risk of meet-

ing with unfavorable weather in spring sowing, and on that account we would recommend sowing in autumn. But it is better the sowing should take place as early in the fall as the weather will permit, or indeed, the latter part of summer, if there is a proper degree of moisture in the soil.

"If the land is loose as some soils are, it will answer a very good purpose to scratch up the surface well with a sharp-toothed harrow, and this is especially the case where the roots of undergrowth exist to a great extent.

AFTER TREATMENT.

"Of one fact there cannot be a doubt, and in this lies the whole secret of having remunerative pastures of blue grass, and that is, do not pasture it to death. It is true, it will stand almost unlimited grazing, but there is a point beyond which it will cease to be profitable, and that limit should never be passed. The better plan is to have the lots divided, and allow the stock on one until it is cropped down, and then, when no longer any pickings can be taken from it, do not allow the stock to continue to tread it simply to have them on a grass lot. It will not only do the stock no good, but, by constant tramping, the grass is unable to throw up any foliage, and in time it will die, for the roots must draw some nourishment from the atmosphere, or they will perish. Allow the grass to recuperate by changing the stock from one pasture to another, and never overstock it. Grass that will keep ten oxen in growing order will fatten five oxen quickly. Stock of all kinds are constant feeders, and there should always be forage enough to enable them to get plenty to eat without the labor of hunting for it.

"There is much variety of opinion on the amount of stock that ought to be put on an acre. This arises from the difference in the capacity of the land, some soils being rich, dry and porous, will stand much heavier grazing than others. It is safer to err on the safe side, and it is better to put in too few than too many. If stock are fattened quickly, they are more remunerative than when fattened slowly. Then, when one lot is sold out they can be replaced by others. Ordinarily, two acres of good grass are requisite for one three-year old ox, and what will fatten one ox will fatten ten head of sheep.

"Blue grass should be allowed to go to seed once or twice, or until the ground is well set or turfed over, and then never more. It is a grass that propagates itself by its creeping roots or rhizomes, and it is the disposition of all plants and animals to lose vitality in the process of reproduction.

"It sometimes happens that dry weather sets in during the summer months, and the grass becomes so dry it will burn. Still stock will greedily eat it. The grass having dried full of nourishing juices, it is equal to the best of hay, and stock will still fatten upon it unless the dried grass has been drenched with rains.

"The fall growth of some lots should be kept untouched by stock, and in this way a fine winter pasturage will be secured. The grass will get high enough to fall over and protect the surface foliage, and stock will keep up their flesh on it during the winter without feed. When snows fall, cattle will require to be fed, but horses, mules and sheep will paw off the snow, unless it is too deep, and get at the grass. It is the first deciduous plant that puts forth its leaves in the spring. Good fat lambs can be sent into the market earlier than from any other grass. It makes milk rich in butter, and gives the latter a fine golden color without changing its taste, or, like clover, imparting its peculiar flavor to it. * * * *

* * * Now, once more, let it be urged on the farmers of Virginia to look into

this matter of pastures, and provide themselves with this highly important adjunct to every farm. No home is complete without pastures, and yet there are many who will depend either upon the fortuitous wild grasses for grazing, or feed their stock from the crib all through the year. With a rich blue grass lot, no stock need be fed, except while at work, and, indeed, it is sometimes the case that in dry, scarce years, crops have been made with horses and mules that had no other provender than a blue grass lot."

Blue Grass will grow in almost every portion of Virginia if the land is made rich; as witness its growth under Walnut and Locust, and on rich spots about old houses. Some fail in it, because in the hot, dry summer it seems to die, and it is concluded to be a failure, and is ploughed up, when if let alone the cool weather and autumn rains will cause it to renew its growth vigorously. Others fail because the first year it comes up it is very small and fine, and is scarcely visible to the most careful inspection, and when let alone it increases its size but little the first summer, and oftentimes the third year the stand will seem to be imperfect, but in the third and fourth year it spreads rapidly and covers the whole ground. Under this condition in the first years persons unaccustomed with its habits are tempted to plough it up. On account of this slow maturity when seeded, it is better to sow this grass with Orchard Grass, and Tall Meadow Oat Grass, and Clover, so that these may occupy the ground at once, while the Blue Grass is advancing slowly. It will ultimately take possession of the ground, and for this reason should never be sowed with other grasses for permanent meadows, as it will root them out.

FORAGE PLANTS.

By Forage Plants we generally mean any plant not grown for the grain or for hay in the strict sense of the term. Many of these are cultivated in Europe, and a considerable number have been tried in the South. Lucerne and Sainfoin might perhaps be properly included among forage plants, though they are sometimes cured for Hay. We doubt whether any forage plant will ever be more valuable where corn grows well than

FODDER-CORN—ENSILAGE.

More of this can probably be raised to the acre than any other forage plant, and it has assumed additional importance from the system of "Ensilage" which has been adopted in connection with it in recent years. It is claimed that forty tons per acre, of fodder-corn, may be raised, and indeed M. Goffart, of France, who has written a work on "Ensilage of Maize," claims to have raised *eighty* tons, though he says his land is naturally poor. Of course, Fodder-Corn will be successful wherever Corn will succeed, which shows its extensive use; and a great argument in its favor is that it is *not an Exhauster of land*, and that not being generally saleable from the farm, all is ultimately returned to the land, which is not appropriated in building up the tissues and bones of animals. When hay is cured, or corn raised, there is a great temptation to sell it. That it is not an exhauster we have the testimony of farmers who have tested it, besides the reasons which present themselves that it should not be. It shades the ground very thoroughly during the hot suns, does not form grain, and leaves all its roots, and some shatterings of fodder to be returned to the soil. Mr. C. R. Moore, of Northamp-

ton, Va., who has been raising it for years, has informed me by letter that he has carefully noted its effects upon land, and that land he has kept in it, year after year, has not only not depreciated, but has actually improved some in productive capacity. This is a great advantage, if its true, and we do not doubt the accuracy of Mr. Moore, who is a very close observer. Another advantage of this crop is that it may be put on land from which Wheat and Oats and Early Irish Potatoes have been removed in time to cut before frost. Some advise that two bushels per acre of corn should be seeded, drilled in $2\frac{1}{2}$ feet between the rows, and some ten or twelve grains to the foot in the drill, but Dr. Jno. M. Bailey, of Massachusetts, who raises it extensively for Ensilage, and who has written a work on this subject, sows only three pecks per acre, saying that the corn will mature better if not too thick, with more starch and sugar in the stalk. He sows a mammoth variety, which makes large and heavy growth, and others who have tried it greatly prefer the large Western or Southern Corn to the kinds usually cultivated at the North. Fodder-Corn, if cut to be cured for hay, is very difficult to cure, as when cut it is full of sap, and the days have become short, and the nights cool and long, and if attempted to be housed, even when it has stood in the fields a long time, it frequently heats and spoils. Consequently most persons leave it shocked in the fields to be fed during the winter as needed. By this plan it is washed and rotted by the rains and snows until much of its nutriment is lost; besides, there is much lost by shattering in moving it and by scattering by the winds. All this is avoided by "Ensilage," which saves it all in good condition, and stalk, and all is readily eaten by stock. When attempted to be cured in the open air, most of the stalk, in the dry state, is rejected by cattle and horses.

Most of our readers have no doubt heard of the system of "Ensilage," which is putting away fodder-corn and other forage plants in pits (Silo) in the ground. M. Goffart, of France, says in his book "that he has been experimenting with this system for twenty-five years, and has only perfected it in the last few years." On the other hand, Prof. Armsby says "the Germans have used this mode of sour fodder for many years before M. Goffart commenced his experiments, and that it was not particularly popular in Germany." But he does not tell us how they saved their fodder, whether they used pits at all or whether they soured it as they do cabbage (sourkraut) for their own use. If the latter, we can very well understand that cattle would not be very fond of it, and that it might not come into general use. By the plan now used, slight fermentation, not further than alcoholic fermentation, occurs while the pit is being filled. This scarcely amounts to sourness, and is not objected to by cattle; indeed, after a few days' usage they will become very fond of it, and reject all dried hays for this, and those who have tried it testify that their cattle thrive on it, increase their milk, &c. But it is not a perfect feed of itself, and requires some bran or meal to be mixed with it.

The pits are dug eight to ten, or twelve feet, and ten to fifteen feet wide, and as long as the farmer desires, which will be in proportion to the quantity of forage to be preserved. Some have the pits partly under ground, as did Mr. Goffart whose soil was not a very dry one, and they may be built above ground by having the sides very tight with plank or brick. The sides are usually protected by plank, nailed to scantling, or by a brick or cement wall, and roof over it to keep out wet. In firm clay, plank and bricks may be dispensed with, particularly if the Silo is under shelter. Last year I had a pit dug eight feet deep, twelve feet

wide, and fifteen feet long, in red clay, with shingle roof, and without planking or bricking, and determined to try the experiment without cutting up the corn, as I had no machinery for the purpose. It was well packed in with the feet of the laborers, no horse or mule feet pressure being used. Pressure was made with heavy rocks on boards placed across diagonally, and the preservation would have been perfect but for the boards being sawed the exact width of the pit at the top by the hand who had this in charge during my absence. The consequence was, that as the pit was slightly splayed to prevent caving, the boards, as they sank with the heavy pressure, caught on the sides, though pressed down in the centre against the corn, and air being admitted, one and a-half to two feet was spoiled on the sides. Below the preservation was perfect, and I fed the "Ensilage" until first of July, not commencing until first of March. The cattle and horses were fond of it, and did well on it. The fodder-corn comes out not green in appearance, having lost the green tinge, but with the juices retained, and with slight alcoholic or vinous fermentation with no disagreeable odor. If the fermentation goes too far, as it sometimes does when too much is gotten out at a time, or the mass is unnecessarily exposed, the odor becomes unpleasant, but even then stock do not refuse to eat it. In feeding, enough should be taken out to last two or three days by removing one of the cross planks, commencing at one end of the pit. In my case, the fodder had to be cut out by means of a sharp spade, and then cut up more fully with a cutting-knife in the feed-room. The implement generally used for cutting up as it is put in the Silo is a cutting-knife, driven by horse or steam power. One patented by Dr. John M. Bailey, and manufactured by Ames & Co., New York and Boston, is highly recommended—prices ranging from \$50 to \$100, according to size. This is for the cutting implement, independent of the horse or steam power. Such an implement is desirable on every farm for cutting up provender of all kinds. In a few days of rainy weather provender may be thus prepared to last many days in the winter, certainly for all the clear days when other work may be done. It is usual, when fodder-corn is put away on a large scale, to trample it in the pit by horses or mules feet (the animals being introduced in the pit by one end being graded for the purpose), though, as above said, this is not absolutely essential. We have thought that human feet were probably preferable, as too much pressure and the action of the feet of horses may press out too much juice and thus produce too much fermentation.

Fodder-Corn, thus prepared, is not of itself a perfect feed, lacking the Albuminoids, or flesh-formers. If green pea vines were ensilaged along with the fodder-corn this want could be supplied, and we should have an excellent feed without other addition, except some grain for horses when hard worked. When fed without other hays or grain, some bran or meal, or both, should be mixed with it. Our readers are probably aware that much has been written on the subject of Ensilage, and that extravagant claims have been set upon one side in its favor, while the doubting have contended that it was not more valuable than Fodder-Corn cured as Hay. We have enumerated some of the advantages of this system, principally the great economy in its favor; and here we may state, that practical farmers conclude that this plan is not more expensive, or not as much so (some say) as preserving this forage in sheds and barns with more certainty of its keeping by Silos. Another advantage in this system is, that stock relish this feed more than they do dry feed, and will eat more of it. We know by experience how tired animals get of dry food fed all the winter, and how anxious they are

in early spring for a "bite" of something green, and how their coats and general appearance improve under green food. Ensilage supplies this want until the pastures and fresh grasses can be used. Analysis, furnished in Prof. Armsby's book and elsewhere, prove that ensilaged fodder-corn is slightly superior in nutritive constituents to that in the dried state. But admitting there is no difference in this respect, we know how a change of food is relished by the human and how much more we can eat of nice fresh beef, or mutton, or turkey after we have been feeding for a long time in the winter on bacon and other salt diet, and how much we improve in feeling and strength on such change of diet.

We should have remarked that the cultivation of fodder-corn is simple and cheap—only running a cultivator a few times in the row, if the land is previously well broken up and prepared as it should be. The time of cutting the fodder-corn is when it begins to silk pretty freely, and even if a few ears have formed, it is not objectionable, as it adds to the nutrition.

Almost all green feed may be ensilaged—as pea vines, rye, oats, and probably clover, but the corn-plant is best. Those desiring further information on the subject may consult Dr. Bailey's and M. Goffart's treatises, and the various articles which have appeared of late in the Agricultural journals on Ensilage.

SORGHUM—CHINESE SUGAR CANE—SORGHO—(*Sorghum Nigrum*).

There are many varieties of sorghum, and its uses are several, viz: as a forage plant (for hogs particularly), and as a producer of molasses and sugar, and the grain is very useful for stock, many say as much so as oats. There are two principal divisions of sorghum, having reference to the countries from which it originated—the African or Impehee, and the Chinese or Sorgho. The seed of the former are more in clusters and heads—of the latter more spreading and loose, like Broom Corn (*Sorghum Saccharatum*), which is considered by some Botanists a variety of sorghum and others as distinct. The two plants are easily intermixed if planted near together. As a forage plant, the Honduras furnishes the most growth and weight per acre—as sugar-producing, the Early Amber, originating in the West, and believed to be a cross of different varieties, is most cultivated. For molasses, the Honduras, a mixed variety, the Dark Liberian, Link, &c., are cultivated. The Early Amber makes also good syrup, but it crystallizes very readily, and half the molasses is sometimes found converted into sugar, and difficult to get from the barrel. Indian Millet (*Sorghum Vulgare*), called also White Liberian,* Egyptian Corn, Guinea Corn, or Dhourra, is more valuable for the grain, which is white, nearly as large as Popcorn, and is contained in a large thick head, the stalk of which has curved over on itself in a half circle. It yields a large amount of grain. This is said to be good food for stock if ground up, and is much relished by hogs and poultry in the winter unground. The stalk of this variety seems deficient in saccharine matter, and it is chiefly valuable for the grain. We raised some of it this year thinking we, with other varieties, would make molasses of it, but find it will not answer for that purpose. This, and all varieties of sorghum, stand drought admirably, much better than corn, no doubt from the fact that it sends its roots deeper and broader into the ground (it leaves a tremendous "tussock" in the soil), and from the further fact that it is a tropical plant inured to heat and drought. More than half of the White Liberian referred to was robbed

*The Botanist to the U. S. Department calls it "White Liberian."

of its seed by the wretched "English sparrows," which our State authorities were so unfortunate as to introduce some years ago for the purpose of destroying the insects on the trees in the "Capitol square." The insects are still there, and the birds have flown to the country and in flocks of almost thousands are depredating on the grain of the farmers. Now it is found out, as Goldsmith had told us years ago, that the sparrow tribe is *not insectivorous*, but graminivorous. There is nothing left now for the farmers (unless the State, as some recompense for the mischief it has done, will offer a premium for their destruction) but to make unrelenting warfare upon this pest with guns and traps and breaking up their nests in the spring. They have now hatched and raised their broods, and are depredating upon the few oat stacks that are found, after having fed on the wheat while it stood in shocks and stacks. This is a digression, but we think a practical one, for we fear this sparrow pest is to be a very serious one. Their increase is very rapid. They are hardy and rapacious, and drive off many of the insectivorous birds. We do not know how far they have extended in the country, but we warn the farmers to be on the watch for them, and destroy them in every practicable way. In proof that they are not insectivorous, we have repeatedly examined them, and find no insects, but grains and seeds in their stomachs (or craw), and a gentleman not long since reported in one of the Agricultural Journals that he had examined many of them without finding that they had swallowed an insect. We have watched their habits, and do not find them pursuing insects, but always after grain.

Sorghum is very well adapted to feeding to Hogs in the green state after the seed begin to mature; they will chew the stalk, and extract the sweet syrup, and also eat the seed, and improve on it very fast in conjunction with a little corn. It is thought not to be safe to feed to cattle after the grain and stalk begin to harden, as the stalk is very flinty, and the accumulation in the stomach might be dangerous, and indeed we have heard was sometimes fatal. If fed to cows, it should be fed when young, and then the sugar has not formed to any degree, and even when young the stalk is more or less flinty. Cows do not have the discretion to reject the stalk as hogs do, or more probably it is a difference of taste, implanted by nature.

The cultivation of sorghum is simple—sow in drills $2\frac{1}{2}$ to 3 feet, according to quality of land, 10 or 12 pounds to the acre, endeavoring to put some eight seed to the foot—if too thick, it can be thinned or cut out with the hoe. On land well-situated for it, it may very well be checked and planted in checks five or six stalks in the hill. It is better cultivated thus. Running the cultivator two or three times in the rows is sufficient, but the weeds must be kept down with the hoe when the plant is young, as it grows slowly at first.

THE COMMON PEA—(*Pisum*).

There are several varieties of field Pea, brown, black, &c., but the latter is generally seeded for field cultivation and green fallows. We do not propose to enter here into a discussion of the advantages of the Pea as an improver of lands—suffice it to say, it is admitted to be a great improver, and there is scarcely any land in Virginia, no matter how poor, unless sand banks, undrained land, and rolling land which has had its soil washed off, that cannot be brought to a profitable state of cultivation by pea fallows, and lime, or marl, particularly if Rye is conjoined,

by sowing Rye in the fall, turning that under after it begins to head, and following with Peas to be fallowed in in the fall; then after liming, some grain crop to be seeded, with clover early in the spring, or if the land has not been sufficiently improved for this (which it may not be, particularly if the growth of the Rye and Peas was not good,) then repeat the Rye and the Peas.

As a forage plant, field Peas are valuable. If cured, they make an excellent, very nutritious hay, and if cut when the Peas are beginning to mature, they make an excellent feed for ewes and lambs in the winter and spring. As suggested above, Peas may very well be added to "Ensilage" fodder-corn, as it will add to the nutritive value of the latter by furnishing Albuminoids.

Peas may be seeded in July up to the 15th, about 1½ to 2 bushels—some sow one bushel, but it is safer to sow more to get a good covering of the land.

VETCH OR PATRIDGE PEA—(*Vicia Sativa*),

Vetch is highly regarded in Europe as a forage plant, though here it is considered a pest by those raising small grain. It makes a vigorous growth, is nourishing, useful to feed green, or to cure, though it is not easy to cure, and requires care. In some of the Southern States, it is used to graze stock on in winter, and turn under in spring. Those who do not raise small grain might give the Vetch a trial, as it is hardy and productive.

RAPE, OR CALISEED, THE CAIZA OF FRANCE AND OUR SPRING KALE.

This is highly esteemed in France and England, and is very productive here if seeded on rich land. A writer in the "Journal of the American Agricultural Association," Mr. Fust, an Englishman, now of Canada, says it is his favorite food for sheep, and that it will make them "ripe fat" without any other feed. He says: "Cows love Rape; and give plenty of rich milk on it. * * Insects never trouble it; as it is sown broadcast, it requires no hoeing, and no weed can struggle successfully against it. It is grateful for manure, but on good land of moderately heavy character, it can do without it. A few—say ten bushels of bonemeal per acre, mixed with as many of ashes, will, on light soils, produce a crop so luxuriant in its lush abundance, that the eye is enraptured at the sight. If it is wished that the ewes should twin in the spring, a fortnight on rape before they are put to the ram will have the desired effect. In 1853 my Hampshiredown ewes—250 in number—gave birth to 397 lambs. Of 15 that lambed one night came 29 lambs. They had lived on Rape from the 25th August to 15th September. The plant grows so high, and is so sturdy and thick on the ground, that sheep do not trample it down as they do grass or clover, for which reason they may be turned loose in the field of it, though the most economical plan is to divide off a piece every two days or so. If a wire is run loosely along the top, the sheep may try to jump at first, but after a few attempts, the shock they receive in falling back from their spring will so astonish their weak nerves that they will shun further adventures. It is in this way alone that the Welsh mountain sheep—the wildest domesticated animal in existence—can be kept within bounds. A fresh piece of rape, or of any other succulent vegetable, should always be given in the afternoon—say about 3 o'clock—when the sheep's bellies are pretty full and the dew has not begun to fall."

“The preparation of the ground for this crop is simple enough. A good deep furrow in autumn should be cross-ploughed in spring,—the harrow, grubber, and roller if wanted, will complete the job. The seed, six to eight pounds per acre, can be sown by hand or with any of the broadcast machines, covered with chain harrows or simply rolled in. It should not be buried more than half inch deep, If this is finished by the first week in May, the rape will be feedable by the 20th June, unless the weather is very unfavorable. Successive sowings should be made every fortnight until the middle of August, and if the earliest piece is not very strong when fed off, it may be resown, and the sheep run over it again. As to manures, I have found the following recipe answer well :

“Take for each acre eight bushels of bone meal; mix them with three times their bulk of ashes or earth; keep the heap damp, and turn it over twice at intervals of ten days. Three hundred pounds of Peruvian guano answers best as a manure on heavy land; as the stem and leaf is what we want for nitrogen. In Kent and Hampshire (England) the farmers burn the grassy borders of their fields and spread the ashes for this crop. It is the first crop grown on the thin chalk soils of Sussex, the whole surface being pared with the breast-plow an inch deep, and the ashes never fail to produce abundant food.

“The number of sheep that can be kept on an acre of rape of fair, but not extraordinary quality, may be set down as ten. If additional food be given, as cake or corn, more may be added; but alone it will fatten ten sheep or feed seven ewes with their lambs. As fast as the land is cleared, the plow should follow the fold, covering in the manure and the stumps, and leaving the soil to consolidate in preparation for the ensuing crop of grain.

“The expense of this crop, you see, cannot be very great; there is hardly any manual labor required; the seed ought not to cost more than fifteen cents a pound, and part of the bone will be left in the ground for the subsequent crops. For the last sowing I should be inclined to take fourteen pounds of Hungarian grass and four pounds of rape; the grass may be touched with the frost, but the sheep will eat it and the rape together, and the dryness of the one will correct the succulence of the other, though the sheep never scour on rape even in frosty weather.”

We give this extract, hoping it may induce some one to try Rape, or Spring Kale (which we understand is the same), on good land as a forage plant to feed off green (by soiling), or to graze their sheep on. We only have used it in Virginia as a market or family salad. Let it be tried as Mr. Fust advises. When used for salad, it is cut over every few days closely, and it continues to spring up, and of course no one here knows how much forage could be raised on the land if this plant were suffered to grow up, and get its natural growth and vigor.

PRICKLEY COMFREY—(*Symphytum Officinale*).

This plant was introduced into Europe from the Caucasus; and we recently learned from an intelligent English gentleman that it is at this time quite considerably cultivated in England: When first introduced into this country it was very much lauded, perhaps extravagantly so, and not coming up to these rose-colored accounts, reaction against it was produced, and many abandoned it. Nevertheless, we are disposed to think favorably of it. We have tried it in a small way in our garden. It requires to be planted on rich ground, or the land must be manured in hills or trenches. It is propagated from root cuttings, and may be

2½ to 3 ft. between the rows, and the plants 16 or 18 inches apart in the rows. It may be worked with the Cultivator run several times in the rows, and the hoes to be used if it becomes grassy, but it seems very much disposed to crowd out grass and weeds. It may be cut at least four times in the season if the ground is good. It stands drought remarkably well, coming, as it does, from a hot climate, and sending down long, large tap roots. Stock, particularly hogs, eat it well, after they have been accustomed to its taste. It is bitterish, with considerable mucilage, much more than any other plant we know of. At first hogs and cows do not seem to relish it, but they soon come to like it and eat it freely. We have fed it both to hogs and cows, and though having no analysis of it, we believe it possesses excellent nutritive properties. When once planted it requires no renewing for years, if kept manured and cultivated. We advise a trial of it for soiling hogs and cows. On land suited, it would be well to cultivate it both ways, say 3 by 2 or 2½ feet and worked with cultivator.

WHETHER A VARIETY OF GRASS SEEDS SHOULD BE SOWN TOGETHER.

There are some reasons why this should be done, though in practice it is not general—that is, when reference is had to more than two or three varieties. It is said that a few grasses rarely occupy the whole surface; that where one fails another will take its place; that some grasses grow in tussocks and leave vacant places, and others should come in to take the places or else pests will do so; that different grasses require different constituents in the soil, and what one rejects another will take up; that if we take a foot of grass land, which has been long in grass, we shall find many varieties (sometimes as many as 20), &c.—reasons which do not seem to be without force, particularly where permanent pastures are desired, as grasses are yearly dying out, and they mature at different times so as to furnish food all the summer for stock. The practice in the Northern and Eastern States is usually to sow Timothy, Red Top and Clover together; at the South, Clover and Orchard Grass, and sometimes Meadow Oat Grass. For permanent pastures it might be advisable to sow a variety of grasses. Flint advises the following:

	Pounds.
Meadow Foxtail, flowering in May and June.....	2
Orchard Grass, flowering in May and June.....	6
Sweet-scented Vernal, flowering in April and May.....	1
Meadow Fescue, flowering in May and June.....	2
Redtop, flowering in June and July.....	2
Kentucky Blue Grass, flowering in May and June.....	4
Italian Rye Grass, flowering in June.....	4
Perennial Rye Grass, flowering in June.....	6
Timothy, flowering in June and July.....	3
Rough-stalked Meadow, flowering in June and July.....	2
Perennial Clover, flowering in June.....	3
White Clover, flowering from May to September.....	5
	40

Messrs. Lawson & Sons, experienced seedsmen of Edinburgh, Scotland, recommend a mixture of 15 varieties (Flint); many of them the same as those just mentioned. Flint recommends the following for permanent lawns :

	Pounds.
Meadow Foxtail.....	2
Sweet-scented Vernal Grass.....	1
Redtop.....	2
Hard Fescue.....	3
Sheep's Fescue.....	1
Meadow Fescue.....	4
Red Fescue.....	2
Italian Rye Grass.....	3
Perennial Rye Grass.....	6
Timothy.....	3
June Grass.....	4
Rough-stalk Meadow Grass.....	2
Yellow Oat Grass.....	1
Perennial Clover.....	2
Red Clover.....	2
White Clover.....	6
	44

This mixture will resist the effects of our severe drougths better than those commonly used for lawns. If anything is omitted from it, the red and perennial clovers, the yellow oat grass, and a part of the rye grass, could best be spared.

For Virginia, the Orchard Grass and Clover make a popular mixture. In a few years, however, the Clover will die out and leave the Orchard Grass, which does not come to perfection until the third year. In some portions of Tidewater and Middle Virginia if land is left in grass more than two years Wire-grass will take possession of much of the field, and that with us does not furnish any hay for cutting. In such localities clover alone will do best, to stand only two years, but the land must be well improved to pay in clover. For Meadow land somewhat moist, Timothy and Herds Grass (Red Top) make a good mixture; neither of these grasses making paying crops of hay on high land unless very rich. Herds grass will give tolerably fair summer pasture on high land, and White Clover also is very useful in the summer for stock, though, like Red Clover, after the first crop it will produce salivation in horses.

BEST GRASSES FOR MEADOW LAND.

By Meadow land, we refer to bottom land, not necessarily wet, as no land should be constantly, but with more moisture and less exposed to suffering from drougth than high lands. For such land one peck of Timothy, half bushel of Herds Grass (Red Top), to which some add four quarts of White Clover. If quick returns are looked for one gallon of Red Clover may be added. This will disappear in two or three years, particularly if not allowed to seed by mowing it early.

We may remark here that the quantity of grass seed varies very much, as seeded by different farmers, particularly as regards Timothy and Herds Grass. These

grasses are much seeded together in the Eastern States. Flint, in his work on Grasses, says he received replies from two hundred farmers on this point of quantity of seed. Some seeded as much as $1\frac{1}{2}$ bushels Herds Grass, with 4 quarts of Timothy and 3 pounds Red Clover; another 1 bushel Timothy, 1 bushel Herds Grass and 10 to 15 pounds Red Clover; another 1 bushel Herds Grass, $\frac{1}{2}$ bushel Timothy and 10 pounds Clover; another $1\frac{1}{2}$ bushels Herds Grass, $\frac{1}{2}$ bushel Timothy and 4 pounds Red Clover, &c.; while others sowed less, as 4 quarts Herds Grass, 1 peck Timothy, 2 quarts Red Clover and 1 pint White Clover—the least quantity reported. Our Herds Grass is the Rep Top; in the Northern States, they generally call Timothy Herds Grass.

FERTILIZATION OF GRASS LANDS—INCLUDING IRRIGATION.

The best application for Grasses is Stable Manure, where it can be gotten, applied in the winter or spring. This can rarely be obtained in sufficient quantity. Then we must use Fertilizers rich in Ammonia, and Potash and Phosphoric Acid. Nitrate Soda, 100 to 200 pounds per acre, applied on Grass is an excellent application, one much used in England. Water by irrigation for Meadows is one of the best of all Fertilizers. Almost every summer we encounter more or less of drouth, sometimes very protracted, as in the present year, when we can look for no second crop of grass for cutting or grazing. It is true we have much land in Virginia unsuited for irrigation, but there are many meadows and lowlands not cleared up which would make profitable grass lands if irrigated from the streams on which they are located, as they might be by dams and supply canals. In some sections, particularly in the Valley, imperfectly irrigated meadows are found which yield a steady crop of hay year after year, and which promise to be productive indefinitely. Large sections of our State are not adapted to the continued growth of grass, and with the exception of very favorable localities, the best meadows begin in a few years to deteriorate, and to run out. They are then plowed up, put in some crop and again put down down to grass, which in a few years falls back in production so as to be of little value. Generally the yield of grass is in proportion to the supply of water, for no solid nutriment reaches plants except as supplied by its solution in water, and the nutrition of plants seems to depend greatly upon the supply of water that can be taken up, sufficient nutriment being provided for in the water. Stewart (Irrigation for the Farm, Garden and Orchard) says: "Rye Grass upon irrigated fields, richly fertilized, has grown at the rate of one inch per day, and repeated cuttings have been made at intervals of fourteen days, during a season of several months. Crops of grass upon irrigated fields of a total weight of more than eighty tons per acre in one season, have been reported by trustworthy English farmers. Irrigated grass fields in Italy support easily two head of fat cattle per acre every year, and have long done so. In hundreds of localities in European countries are irrigated meadows which have borne grass without any sign of deterioration within the memory of the inhabitants, although the crop has been cut and removed every year during this indefinite period. These products are so far beyond the dream of American farmers that they may be considered fabulous; but there is no reason to doubt the facts. On the contrary, they should be the stimulus for us to adopt, wherever practicable, the methods by which these crops have been produced."

Our average crop of hay will not exceed two tons per acre, and upon ordinary

lands not more than one ton. On all lands suited for irrigation the hay could be at least doubled, and much land might be brought under irrigation, and much meadow land be prepared for that purpose with a small expenditure. Considering the already great value of the Hay crop, we see that through irrigation our national and individual wealth could be greatly added to. Very little irrigation has been practiced in Virginia, and when resorted to it is generally in localities where water would naturally run over meadows, and even in such cases meadows for years show very little sign of deterioration. In California, Utah and Colorado irrigation has been successfully used. In California the work is much done by companies and is increasing in extent; most of the vegetables used in San Francisco are supplied by irrigated gardens, many of which are cultivated by Chinese. In Utah irrigation is extensively and profitably used, and in 1868, twenty-two years after the first settlement of Salt Lake Valley, 93,799 acres were under irrigation at a cost of \$250,000, and since then the practice has been greatly extended. In the south of Europe it is extensively practiced, and in Italy it has been in use since the time of the Romans. In Italy, near Milan, lands irrigated in winter rent for \$60 to \$100 per acre, while Hay sells for only \$10 per ton. In India the English Government has expended about a million of dollars in irrigating works, with profit to the Government and with great benefit to the people; increasing the productions immensely and preventing famines, which before were of frequent occurrence, destroying many lives. These instances show the importance and advantages of irrigation in dry climates. Of late years we have suffered much with drought in Virginia, which may be in part the effect of clearing up so much land. Many sagacious observers believe this to be the fact, and if it is, there is danger that droughts may become more frequent and injurious, and we may be compelled to resort to irrigation. In any event, farmers would find it greatly to their advantage to irrigate their grass lands wherever practicable. Small dams are frequently sufficient to turn water over meadows. Many other plans are adopted, as windmills to raise the water to elevated tanks, tiles underground, water-wheels to raise water, engines used in wells, &c. Stewart describes the *Noria*, which has been used in Southern and Central Europe since the eleventh century, and as being still used in Savoy, Lombardy, Spain and the South of France. "It is easily constructed, and is cheap where the supply of water is sufficient. It consists of a wheel having broad floats hung upon an axle, so that the lower floats are submerged in the water. By offering a little obstruction to the stream to increase the rapidity of the current, where the natural velocity is not sufficient, the wheel is revolved. Water-buckets are fixed to the circumference of the wheel in such a position that the direction of their longitudinal is 45 degrees from that of the axle of the wheel. The buckets are partly filled as they pass through the water, and are discharged as the wheel brings them around in an inverted position into a wooden trough placed alongside of the wheel. From this trough the water is conveyed to the distributing channels. Water may be raised in this rough and ready process in the cheapest manner to a height of ten or twelve feet, requiring no attention, and working by day and night so long as the stream flows."

There is no doubt but what the hay crop in Virginia could be greatly increased by cheap modes of irrigation, and in such a season as we have had this year the advantages of such increase would be very great, and would relieve many farmers from anxiety in regard to wintering their stock.

Commercial Fertilizers are frequently used on Grasses. The soil and the kind of grasses should determine which of the constituents, Ammonia, Potash, and Phosphoric Acid, are most needed. Clover is found to be particularly benefited by Potash and by Lime, and for getting a stand of Clover, Ammonia is important. After the land has been in clover for some time it gradually collects Ammonia in the soil, some from the atmosphere and some from the soil by sending down its tap-roots deep in the subsoil. Potash is necessary for grasses on light or worn lands, and not so important on stiff clay or new soils. Phosphoric Acid is very important for grasses, particularly permanent pastures or pastures which have long been fed on, as the phosphate of lime is exhausted by constant grazing. It is taken from the soil by stock to form their bone, muscle, and milk. Of the mineral matter of bones near five-sixths consist of phosphate of Lime, with some Magnesia. Bone dust, or the ground phosphates of South Carolina, will generally restore old worn-out pastures, the former most valuable, as, if they are not subjected to heat, they contain 4 to 5 per cent. of Ammonia. A mixture of ground bone and ashes, one part bone, and four of ashes, forms a valuable top-dressing for grasses, whether to stand only a few years or for a number of years. In the latter case, the application should be repeated every few years. If the bones are only crushed or coarse ground, then unleached ashes should be used, and it is better they should be put together first for a few weeks and kept moist by sprinkling of water. The ashes serve to make soluble the bone, which will occur gradually in the soil, but more rapidly when put together as just indicated. If the bones are fine ground, or South Carolina phosphates fine ground is used, then leached ashes will answer a very good purpose. By leaching they lose most of their potash and not much phosphoric acid, of which they contain 5 per cent. (oak ashes). Leached ashes alone are said to be very valuable for grasses and pastures. Careful experiments by practical farmers are said to show that land producing one ton to the acre of hay has been so benefited by leached ashes as to yield three tons per acre. Plaster (Sulphate Lime) exerts a very favorable effect on much grass land, while on others it has no effect. No doubt that where Plaster acts it benefits all grasses, and clover, as well as corn, peas, &c.; and that where it fails on one crop it fails on others on the same land. This agent acts with great benefit on the lands of Piedmont and the Mountain regions, and, we believe, in the Valley. In most of Middle, and Tidewater, it has no effect. Why this is so has never been satisfactorily explained, though various theories have been propounded as to the action of plaster. The only reason the writer can see for the nonaction of Plaster on some lands is that those lands already contain enough of this agent. Whether they do, I do not know whether the chemists have endeavored to ascertain by analysis. Some time since a gentleman in King and Queen wrote me that lands which had been marled by himself and neighbors ceased to be acted on by Plaster, while unmarled lands adjoining responded to its action. At the same time he sent me a specimen of "Red Marl," the color being due to iron, as I suppose, in the form of Sulphate Iron, which sometimes occurs in marl deposits. Now it occurred to me that the exposure of this marl to the atmosphere, and heats and moisture might have some of the Sulphuric Acid of its Sulphate Iron liberated, which would seize on some of the Lime of the Marl, forming Sulphate of Lime, and that thus the soil would contain enough of the latter, and fail to be influenced by additional applications.

Ashes are greatly esteemed in Europe, as well as in America, as excellent Fer-

tillizer for grass lands, and in Germany are said to be transported (hauled we suppose) eighteen to twenty miles for this purpose. The hard wood ashes contain about 10 per cent. Potash and 5 per cent. Phosphoric Acid, two things very useful for grasses; and applied to grass lands are said frequently to double the hay crop. This shows the importance of husbanding all the ashes which can be obtained on the farm. Northern farmers frequently apply to thier grass crops swamp mud and Peat—suffered to lie after being obtained until dry, and then mixed with Lime, and perhaps sometimes with Potash and Ground Bone or Phosphate. They think the Mud and Peat with Lime pay well. For Grass land we would use not less than 50 bushels Lime; of ashes, 250 busheis unleached ashes, 250 pounds of Ground Bone or Phosphate, and 100 to 150 pounds Sulphate or Muriate Potash. We are speaking of these fertilizers when used separately. Of course they may very properly be combined.

The applications are best made in late fall or early spring. Nitrate Soda, which is much used in England on grasses, is applied 100 to 200 pounds per acre in the spring. If it is applied in the fall its great solubility causes much of it to wash out of the land before spring growth commences. One hundred pounds are generally sufficient unless the land is poor and deficient in Ammonia and the grass is thin and indifferent, then use more.

SAVING GRASS SEED.

The cost of Grass seeds is something very considerable and worth saving, and while the farmer is saving for his own purposes he may very well save some for market, which is attended with profit. But it is worthy of attention if only enough is saved to pay the expense of his own seed. At present prices the profits of saving grass seed is very considerable, and the demand for seed is constantly increasing. There is no reason why we in Virginia should not save our Clover, Orchard, Timothy, Herds Grass Seeds, and others if there should be a demand for them, and at the same time supply our dealers with these seeds, and save to the State a considerable amount now sent out of it for their purchase. Many Clover seed are saved in the Western portion of the State—not many in the Eastern, and very few of other seed are saved in any portion of our territory. One gentleman we know of in Eastern Virginia (Colonel John Washington, of Caroline) has been very successful in saving Orchard Grass seed of fine quality, not only for his own use, but a considerable quantity for market. Mr. Howard, in his Manual, says he saved the seed from little more than an acre of "Meadow Oat Grass," amounting to six busnels, and realized from it \$18. The grass was cut with a cradle and bound, and threshed with a flail; he saved the hay at the same time, as the seed of this grass ripens while the stalk is green.

MAKING WOOD PASTURES.

By thinning out trees, which may be used for fire, or rails, and all crooked and useless growth, including all undergrowth, if the land is good, very useful pastures and parks may be formed of much land that is now worthless. Many parks are thus formed in England, which are not only valuable for stock, but add much to the picturesque appearance of that beautiful country, so noted for its quiet, unsurpassed landscape scenery. In our State such pastures can be successfully made with a little care. In cleaning out the undergrowth (and trees which may

be used as just suggested) it, with the laps of the trees should be burned, and the ashes carefully scattered; then we would lime the land—fifty bushels to the acre (or marl it)—and harrow it with a heavy drag, sow the grass seeds and roll it, or brush it over. If a rain occurs by the time the seeds are sown, this is not necessary. A woods pasture thus formed is useful for grazing stock, for shelter in bad weather, and oak trees trampled around by stock, rarely fail to bear a good mass of acorns, which are particularly valuable for hogs, and besides this there is the great satisfaction of adding to the beauty of lands and groves which constitute our homesteads. Of course after such lands are set in grass some, almost yearly, application of fertilizers will be necessary to keep them in profitable condition; such fertilizers as we have already indicated.

LABOR-SAVING IMPLEMENTS FOR HAY MAKING.

Of late years the labor of saving hay has been greatly diminished by machinery, at the same time the farmer has more command of the weather, being enabled to save his hay in about one half the time. By the old method, if the cutting of hay was commenced when the grass was in proper condition the latter portion of the crop was over ripe before it could be harvested. Besides this, hands enough to secure a crop of hay with grass blades, would be very hard to obtain now, and added to this is the economy of machinery, which costs less than hand labor. These are great advantages, and strong inducements to farmers to raise the grasses for hay. The saving when all the advantages of machinery are considered is probably one half in a moderate crop, and more than this in a large crop. The implements alluded to are the mower, rake, tedder (for turning over for rapid curing), hay lifter, and loader. The farmer should provide himself with extra pieces and tools for repairing these implements, to save time and blacksmith's bills as far as possible.

NUTRITIVE VALUE OF GRASSES.

The nutritive value of grasses is determined by analyses, and by experience in feeding them. Farmers and stock raisers have generally arrived at quite correct conclusions regarding their comparative nutritive qualities, not always, however. Prof. Way, Chemist to the Royal Agricultural Society, of England, a guarantee of his competency and skill, has given us analyses of the natural and artificial grasses. The grasses are all considered natural, while the forage plants, as clover, Lucerne, Sainfoin, &c., are considered artificial grasses. It is proper to remark that the composition and value of grasses is much influenced by the time of cutting and mode of curing. Of late years it has been found that grasses should be cut early and cured with as little sun as practicable. For instance clover should be cut by the time the *first brown heads* appear, and we should not wait, as was once thought, for many or a majority to turn brown, and it should not be subjected to more sun than is necessary to wilt it well, then it should be put in cocks as already described, and suffered to remain until sufficiently near cured to finish the curing by a few hours exposure to the sun the day it is housed.

Prof. Way ascertained the proportion of water in each grass, as taken from the field; the proportion of albuminoids or flesh-forming substances, including all the nitrogenous principles; the proportion of oily or fatty matters, which may be called fat-forming principles; the proportion heat producing or elements of respi-

ration, as starch, gum-sugar, &c., which are non-nitrogenous; the proportion of woody fibre, and the amount of mineral matter or ash, which includes all the mineral matter which is left after burning, as Phosphate Lime, Potash, Soda, &c., which has been obtained from the natural condition of the soil, or supplied by Chemical or Commercial fertilizers. We shall not burden our columns with a general analysis of grasses as showing their nutritive value, but give only that of the grasses generally grown in Virginia.

Analysis of Natural Grasses—(One Hundred Parts as taken Green from the Field).

NAME OF GRASS.	Water.	Albuminous or Flesh Forming Principles.	Fatty Matters	Heat-producing Principles, Starch, Gum, Sugar, etc.	Woody Fibre.	Mineral Matter or Ash.
Sweet-scented Vernal.....	80.35	2.05	0.67	8.54	7.15	1.24
Meadow Foxtail.....	80.20	2.44	0.52	8.59	6.70	1.55
Tall Oat Grass.....	72.65	3.54	0.87	11.21	9.37	2.36
Yellow Oat Grass.....	60.40	2.96	1.04	18.66	14.22	2.73
Downy Oat Grass.....	61.50	3.07	0.92	19.16	13.34	2.01
Quaking Grass.....	51.85	2.93	1.45	22.60	17.00	4.17
Upright Brome Grass.....	59.57	3.78	1.35	00.33	19.00	2.11
Soft Brome Grass.....	76.63	4.05	0.47	9.04	8.46	1.36
Crested Dogtail.....	62.73	4.13	1.33	19.64	9.80	2.33
Orchard Grass.....	70.00	4.06	0.94	13.30	10.11	1.59
Orchard Grass, seeds ripe.....	52.57	10.93	0.74	12.61	20.54	2.61
Hard Fescue Grass.....	69.33	3.70	1.02	12.46	11.83	1.66
Meadow Soft Grass.....	69.70	3.49	1.02	11.93	11.94	1.93
Barley Grass.....	53.85	4.59	0.94	20.05	13.03	2.54
Perennial Rye Grass.....	71.43	3.37	0.91	12.08	10.06	2.15
Italian Rye Grass.....	75.61	2.45	0.80	14.11	4.82	2.21
Timothy Grass.....	57.21	4.86	1.50	22.55	11.32	2.26
Annual Spear Grass.....	79.14	2.47	0.71	10.79	6.30	0.59
June Grass (Kentucky Blue Grass).....	67.14	3.41	0.86	14.15	12.49	1.95
Rough-stalked Meadow.....	73.60	2.58	0.97	10.64	10.11	2.20
Irrigated Meadow Grass.....	87.58	3.23	0.81	8.98	8.13	1.23
Irrigated Meadow Grass, second crop.....	74.53	2.78	0.52	11.17	8.76	2.24
Annual Rye Grass.....	69.00	2.96	0.69	12.39	12.47	1.99

Analysis of Natural Grasses.—(One Hundred Parts of the Grasses Dried at 212° Fahrenheit).

NAME OF GRASS.	Albuminous or Flesh Forming Principles.	Fatty Matters.	Heat-producing prin- ciples, Starch, Su- gar, Gum, etc.	Woody Fibre.	Mineral Matter or Ash.
Sweet-scented Vernal Grass.....	10.43	3.41	43.43	36.36	6.33
Meadow Foxtail.....	12.32	2.92	43.12	33.53	7.51
Tall Oat Grass.....	12.95	3.19	38.03	34.24	11.59
Yellow Oat Grass.....	7.48	2.61	47.08	35.95	6.98
Downy Oat Grass.....	7.97	2.39	49.78	34.64	5.22
Tucking Grass.....	6.08	3.01	46.95	35.30	8.66
Upright Brome Grass.....	9.44	3.33	.80	02.	5.21
Soft Brome Grass.....	17.29	2.11	38.66	36.12	5.52
Crested Dog-tail.....	11.08	3.54	52.64	26.36	6.38
Orchard Grass.....	13.53	3.14	44.32	33.70	5.31
Orchard Grass, seeds ripe.....	23.08	1.56	26.63	43.32	5.51
Hard Fescue Grass.....	12.10	3.34	40.43	38.71	5.43
Meadow Soft Grass.....	11.52	3.56	39.25	39.30	6.37
Meadow Barley Grass.....	11.17	2.30	46.68	31.67	6.18
Perennial Rye Grass.....	11.85	3.17	42.24	35.20	7.54
Italian Rye Grass.....	10.10	3.27	57.82	19.76	9.05
Timothy.....	11.36	3.55	53.35	26.46	5.23
Annual Spear Grass.....	11.83	3.42	51.70	30.22	2.33
June Grass (Kentucky Blue Grass).....	10.35	2.63	43.08	33.02	5.94
Rough-stalk Meadow.....	9.80	3.67	40.17	33.03	8.33
Irrigated Meadow Grass.....	25.91	6.53	32.05	25.14	10.37
Irrigated Meadow Grass, second crop.....	10.93	2.06	34.30	43.90	8.33
Bermuda Grass.....	12.00	None.			6.50

Analysis of Artificial Grasses—(One Hundred Parts as Taken from the Field).

NAME OF PLANT.	Water.	Albuminous or Flesh Forming Princi- ples.	Fatty Matters.	Heat-producing prin- ciples, starch, gum, sugar, etc.	Woody Fibre.	Mineral Matter or Ash.
Red Clover.....	81.01	4.37	.69	8.45	3.76	1.83
Perennial Clover.....	81.05	3.44	.78	8.04	4.91	1.63
Crimson Clover.....	82.14	2.95	.67	6.70	5.73	1.75
Cow Grass.....	74.10	6.30	.99	9.42	6.25	3.01
Cow Grass, second specimen.....	77.57	4.23	1.07	11.14	4.23	1.77
Hop Trefoil.....	88.48	3.59	.77	7.25	3.74	1.37
White Clover.....	70.71	3.50	.89	8.14	5.88	2.03
Common Vetch.....	82.90	4.04	.52	6.75	4.63	1.11
Sainfoin.....	76.64	4.52	.70	10.73	5.77	1.84
Lucerne, or Alfalfa.....	69.95	3.33	.32	13.62	8.74	3.04
Black Medick, or Nonsuch.....	76.80	5.70	.34	7.73	6.32	2.51

Analysis of Artificial Grasses—(One Hundred Parts of the Grass Dried at 212° Fahrenheit).

NAME OF PLANT.	Albuminous or Flesh Forming Princi- ples.	Fatty Matters.	Heat-producing prin- ciples, starch, gum, sugar, etc.	Woody Fibre.	Mineral Matter or Ash.
Red Clover.....	22.55	3.67	44.47	19.75	9.53
Perennial Clover.....	19.13	4.09	42.42	25.96	9.35
Crimson Clover.....	16.90	3.73	37.50	32.59	9.73
Cow Grass.....	24.33	3.57	36.56	24.14	11.60
Cow Grass, second specimen.....	18.77	4.77	49.65	13.84	7.97
Hop Trefoil.....	20.43	4.67	43.86	22.66	8.33
White Clover.....	13.76	4.33	40.04	26.53	10.29
Common Vetch.....	23.61	3.06	39.45	27.33	6.80
Sainfoin.....	13.45	3.01	45.96	24.71	7.37
Lucerne, or Alfalfa.....	12.76	2.76	40.16	34.21	10.11
Black Medick.....	24.60	4.06	33.31	27.19	10.34

The nutritive value of the food of an animal depends greatly on the proportion of nitrogenous substances it contains; there are Albumen, Gluten, Gelatine, Caseine, Legumen, and fibre, generally classed as Albuminoids, the non-nitrogenous substances are starch, gum, sugar, woody fibre, mucilage, &c. The former go to make muscle, flesh, and blood—the latter to produce fat, and maintain heat and respiration. If oil cake alone, which is only slightly nitrogenous, is fed to an animal it will fatten him but will not give him muscle and size, and if the same animal is fed on roots, grasses and fruits alone his size increases, his muscle are developed, but fat is not formed in proportion. Corn, though mostly non-nitrogenous, contains nitrogen enough to produce growth and fat also, though the animal will not do well on corn or any one article of food alone.

Boussingault gives the following as the "Nutritive Equivalents" of the articles named :

English Hay.....	100
Lucerne.....	83
Red Clover-hay.....	75
Red Clover (green).....	311
Rye-straw ..	479
Oat-straw	383
Carrot-leaves (tops).....	135
Swedish Turnips.....	676
White Silician Beet.....	669
Carrots.....	382
Potatoes.....	319
Potatoes kept in pits.....	383
Beans ...	23
Peas	87
Indian Corn.....	70
Buckwheat	55
Barley.....	65
Oats.....	60
Rye.....	58
Wheat.....	55
Oil-cake (Linseed).....	22

That is, taking English hay as a standard of comparison—100 pounds of that fed to an animal will produce the same amount of nourishment as 83 pounds Lucerne, 75 pounds Clover, 479 pounds of Rye Straw, &c. This table cannot be very exact, but serves as a guide in comparing these articles of food, and gives us a good general idea of the relative value of various agricultural products for feeding. Fresenius, another German chemist, gives a table of the Nutritive Equivalent of the same articles, which varies considerably from Boussingault in some of the items, and seven German experimenters are quoted by Flint as giving the "Practical Value (of same articles) as obtained by experiments in feeding." They both differ from the theoretical estimates made by the two chemists just quoted from, and differ among themselves. These nutritive values are necessarily liable to imperfections on account of the differences of soil, climate, seasons, and some errors no doubt in analyses, besides difference in time of cutting and curing, and maturity of different grasses, and roots, and grains.

In quoting analyses of grasses mostly grown in Virginia, the analyses of many others were omitted. A comparison of the more valuable with those less so shows a great difference in the nutritive value—a difference sometimes of one half.

SELECTIONS OF GRASS SEEDS.

The temptation to mix seeds left over from previous years with new seeds is very strong, and the farmer must exercise great care in obtaining his seed. He cannot be certain his seed are good unless he raises them himself, or tests them before buying. He may do this by covering them lightly with earth in a box and set in a warm place, counting the seed, or he may put them between two pieces of cloth, in a saucer, kept properly but not too wet. The seeds of some plants retain their vitality much longer than others, as Turnips and Melons are said to be good when four years old, and some say they are better when of this age, but the seeds of most of the grasses are of little value when two or three years old.

We give the following useful table from Flint, omitting all the grasses not usually raised in our State :

WEIGHT OF GRASS SEEDS AND DEPTH OF COVERING.

1	2	3	4	5	6	7
Red Top	12	425,000				.63
Tall Oat Grass.....	7	21,000	$\frac{1}{2}$ to $\frac{3}{4}$	$1\frac{1}{2}$ to $1\frac{3}{4}$	4	.....
Orchard Grass.....	12	40,000	0 to $\frac{1}{2}$	$\frac{3}{4}$ to 1	$2\frac{1}{4}$	.29
Timothy	44	74,000	0 to $\frac{1}{2}$	$\frac{3}{4}$ to 1	2	.50
June or Spear Grass.....	13	243,000				.57
Red Clover.....	64	16,000	0 to $\frac{1}{2}$	$1\frac{1}{4}$ to $1\frac{3}{4}$	2	.....
White Clover.....	65	32,000	0 to $\frac{1}{2}$	$\frac{1}{2}$ to $\frac{3}{4}$	$1\frac{1}{2}$	.....
Lucerne.....	60	12,600				

Column 1 contains names of grasses ; column 2, average number of pounds in a bushels ; column 3, average number of seeds in an ounce : column 4, the depth of soil in inches at which the greatest number of seed germinate ; column 5, shows the depth of soil in inches at which only one half the seed germinated ; column 6, shows least depth of soil in inches at which none of them germinated ; column 7, show the average per cent. of loss in the weight of grass in making into hay when cut in flowering.

I have recently had inquiries about the "Johnson, or Means Grass," called also "Egyptian Sugar Cane," as it is a native of Egypt, and is said by its great luxuriance to have so filled the upper portion of the Nile that a canoe cannot be driven through it. The grass is very hardy, and will grow almost anywhere, but is objectionable in one respect, that is the difficulty of eradicating it. Dr. Killebrew says of it (Grasses of Tennessee), when young it is very tender and sweet, the pith being full of sugary juice. The leaves are as large as Corn-fodder, and very nutritious. It has a perennial root, and so vigorous that when once planted it is difficult to eradicate it. * * It is a fine fertilizer, and sown on a piece of poor washed land will in a few years restore it to its pristine fertility. * * It will bear cutting three or four times a year, and this has to be done, for when it matures the seed, the stem and leaves are too coarse and woody for use.

In a recent conversation with Dr. Killebrew at Atlanta, he said to me, in respect

to this grass, that he had recommended it highly in his book, but he hesitated to do so now on account of the difficulty of eradicating it—a great objection to our wire grass, which at the same time has much to recommend it.

ATLANTA EXPOSITION.

Having been appointed one of the Vice-Presidents of the International Exposition at Atlanta, I thought it best to attend it for the purposes of instruction and of making some Report on things exhibited. It was first intended as a Cotton Exposition, but it was soon found best to enlarge it so as to include products of all kinds, Machinery, arts, &c.

This Exposition or "World's Fair" is a great success. It is not indeed a "World's Fair," as every thing exhibited comes from the United States, unless it be some teas, and some samples of foreign manufacture, furnished by the State Department of the United States, and sent to this Department by United States consuls. They add but little to the Exposition, and do not speak much for the taste and diligence of our consuls, or else little for the skill and advancement of the countries they represent. We noticed in the collection the celebrated "Cosmos Fibre" from Europe, we think from some of the German States, which is making a noise in the world, as a substitute for wool. It is prepared from some vegetable fibre, by chemical process, and if not an entire substitute for wool, is claimed as mixing much better with wool than cotton can be made to do. It will make nice fabrics of itself.

We regretted to see Virginia so poorly represented in the Exhibition. While most of the Southern States, and some of the Western, are finely represented, Virginia has nothing but some minerals from the line of the Virginia Midland Road, coal and natural coke from Chesterfield, and some Magnetic Iron Ore, Copper ore, Asbestos, Slate, Fire Clay, Ochre and Granite from the line of the Richmond and Danville Railroad. and some grains and seeds (quite a good selection), and a very handsome granite monument, prepared from our granite, by the "Richmond Granite Company." Among the Virginia minerals were iron ores and manganese from Green Bay, the finest soapstone from Arrington Station, marble from Madison Station, brownstone from Manassas, Prince William paint ores, copper from Green Bay, iron (red hematite) and manganese from Happy Creek, copper, and kaolin, and sand glass from Beverly Station. The great iron deposits of Pittsylvania, Bedford, Campbell, Amherst, Botetourt, Alleghany, and the Valley of Virginia, were unrepresented, as were unrepresented our extensive deposits of gold, kaolin, spar in Middle Virginia, and the coal, salt, plaster, lead, zinc and other minerals of Southwest Virginia. While Virginia is as rich in minerals as any other State in the Union, unless it be North Carolina, and in coal we surpass that State, and we think probably in iron (the two most important of all minerals), we were worse represented than any other State represented at all. While other States had large exhibits of all their cereals, grasses, and forage plants and fruits, we had nothing in this respect but the grains (in bags) mentioned. We warned our people of the great show that was to be made at Atlanta, and the importance of their being properly represented, but no attention was paid to it, and while other States are destined to reap great and lasting benefits from it, we shall obtain very little.

As an *Industrial* Exposition, we believe it is the best which has ever been made

in the history of the world. Such a mineral collection, such an exhibition of farm products (in spite of the drought), and of machinery, was scarcely ever gotten together before. In these respects we heard the opinion expressed that it surpassed the "Centennial" (which we did not see), and we think in these things it also eclipsed the "World's Fair" in London (which we attended) in 1851. Since that time machinery, particularly for farms, has been much extended. The cotton machinery at Atlanta was large in quantity and wonderful in its operation. The action of this and other machinery seems something marvelous, and if we did not know that the human mind and human genius had arranged and adapted it to its various ends and set it in motion, we should be apt to imagine it was something itself endowed with reason and thought and purpose. Beside this extensive cotton machinery, we have two firms (Coats and Wilnammentic Companies) making spool cotton from the raw material, and manufacturing the boxes to put it in, the weaving of cotton cloths, woolen goods and silks, besides machinery of almost every kind and for every purpose. The Northern manufacturing companies, with their usual shrewdness, saw their opportunity, and improved it, and will reap their reward. We were never before so impressed with and informed about the resources of the South, and the time must arrive when the South will become the richest portion of the Union, save, perhaps, the Northwest, and that (besides the severe winters, which will drive many away) has not as many natural advantages as the South. We were greatly surprised, as well as pleased, at the extensive mineral resources of Tennessee, North Carolina, Georgia, Alabama and Kentucky, as shown at this Exhibition. Colorado, on this occasion, made a very handsome mineral display. We were particularly struck with a gold ore from Colorado said to contain in a ton \$50,000 of gold, and yet not a particle of the precious metal could be seen in the specimen. We believe Colorado has furnished more gold for the mints in the last year than California. The silver ores, too, from Colorado were very rich.

The Exposition has been a great success, and will be great advantage to the South in furnishing to the world an insight into the resources of this section, which, without question, possesses more material wealth than any other portion of the United States. The mineral wealth of Virginia, Tennessee, Kentucky, North Carolina, South Carolina, and Alabama is very striking, and must bring a great amount of capital into these States. While North Carolina is not prominent in coal, it has a great variety of minerals, and among them is a new gem, *Hiddenite* (named from the discoverer), which is exciting much interest. It is an emerald of great purity and beauty, and is said to be nearly as valuable as the diamond, and the jewellers everywhere are seeking for it.

The cotton States are arousing themselves to the importance of manufacturing their raw materials, particular cotton, and establishing factories. Now is their time while we have a protective tariff and the assistance of Northern capital can be had. Virginia is extending her cotton belt, and being contiguous to the great cotton States, with extensive water power and excellent climate, should become a great manufacturing centre for cotton goods and iron industries. Richmond, with the splendid iron ores of the James River Valley, coal of Chesterfield and the large deposits of coal now being developed in the Southside counties (Wise, Scott, Buchanan, &c.), should become the Pittsburgh of the South.

IN CONCLUSION.

I again urge upon farmers perseverance and close attention in the conduct of their farms, and exhort them not to be discouraged by their unsuccessful crops. It will not always be so, if there is no relaxation in their efforts, which will ultimately be crowned with success. Remember what our forefathers went through in our early colonial history, clearing up forests with the axe, with rifles by their sides to protect their lives from the hostile Indians. Our famers of the present day, after the devastation produced by the late civil war, have many discomforts and much hardship to contend with, but let us remember how our predecessors lived, what economy they were forced to practice, what few appliances they had to relieve labour and promote comfort in their homes, and how they had to toil and labor from morn till evening to conquer the forests, to till lands never before broken by the plow, and to plant untried seeds in order to make a scant subsistence for themselves and families. Their houses were of the plainest and most primitive character, with none of the modern appliances to cheer and alleviate their daily toil, while their clothing and their furniture were of the roughest and plainest character. A modern writer, speaking on this point, says: "There are a few of the old houses still standing in the country which have battled with the storms of a hundred years. * * These houses have an interior arrangement suggestive of cold comfort, and combine but few of the conveniences for the benefit of the family. * * But little progress had been made in invention and the arts, and hardly one of the contrivances for cooking, and warming and lighting dwellings was known; not a pound of coal or a drop of kerosene oil had been burned in the country. No iron stoves were used and no contrivances for economizing heat were employed until Dr. Franklin invented the iron-frame fire-place, which still bears his name. All the cooking and warming was done by the aid of fire kindled upon the brick hearth, or in the brick oven. Pine-knots or tallow candles furnished the light for the long winter evenings; and sanded floors supplied the place of rugs and carpets. Water for household purposes was drawn from deep wells by "sweeps," or gotten from springs often a long distance from the house. * * No form of pump was used in this country, so far as I can learn, until after the commencement of the present century. There were no friction matches in those early days, by aid of which a fire could be speedily kindled, and if the fire upon the hearth 'went out' overnight, and the tinder was damp, or there was no tinder at hand, the alternative remained of wading through the snow and cold a mile or so to borrow a brand from the nearest neighbor." Even I can well remember when there were no matches, and that fire had sometimes to be sent for to a neighbor's. These things are mentioned to show some of the hardships and troubles of our noble forefathers, and to incite us to imitate their self-denying examples. They struggled on until they established themselves and their children in independence and comfort.

I do not thus write because I doubt the moral courage and physical endurance of Virginians, but every one appreciates sympathy and encouragement, and it incites them to new exertion, particularly if they are shown good reasons for exertion. The people of Virginia have been tried in too many fiery furnaces for any one to doubt their metal now. Each time they have come out brighter by the test, if that is possible, and they have ever met troubles and trials and dangers

with a steady step and undaunted front. Virginia has seen many reverses, and has had hard experiences, but we are sanguine that a prosperous and bright future awaits her. Let none of her sons or daughters despond; we earnestly believe that "Nil Desperandum Est" is far more applicable to Virginia now than it was to Rome in the zenith of her glory.

One more word to the farmers personal to myself. I have endeavored to serve you faithfully for the four years and nearly a half of my official existence, which I am admonished, by the mutations of parties in our State, is now coming to a close. In all weathers, irrespective of my precarious health, I have repaired from my farm near the city to my office, and in the period mentioned have never taken but one week of relaxation. I have worked for you day and night, for I have not been able to prepare my reports except by night work, which I am at this moment performing. My correspondence has become so large that much of my time has been consumed in carrying it on. I am not without my reward, for I have received so many testimonials from those I have been serving of their appreciation of my labors that I feel compensated for my exertions in their behalf. While the office I hold is in no sense political, and has no patronage attached to it, and has never been in any respect wielded for political purposes by the incumbent, and while no politician or partisan, never attending a political meeting, I have, as a duty and a matter of conscience, exercised the sacred right of voting my opinions.

I shall ever cherish the commendation my fellow-farmers have bestowed on my labors in their behalf with a grateful remembrance, and will ever pray for their success and prosperity, and hereafter if I can in any way aid them, they have only to command my services and I shall be forthcoming.

Analyses of Fertilizers made for the Department of Agriculture of Virginia, in 1881, by Dr. William H. Taylor, Chemist to the Department.

No. of the Analysis.	Name of Fertilizer.	Name of Manufacturer.	Moisture at 212° F.	Phosphoric Acid.			Potash.	Soda.	Available Ammonia.	Price.		Estimated Cost.
				Soluble.	Precipitated.	Insoluble.				Crop-Time.		
1	Pure Ground Bone.....	Patapasco Fertilizing Co.....	6.18	.....	.....	.....	.80	1.76	4.79	.....	.....	\$39 10
2	Allison & Addison's Complete Tobacco Manure.....	Allison & Addison.....	17.98	5.95	3.41	.86	1.59	2.08	3.93	.....	.....	43 08
3	Orient.....	Atlantic & Virginia Fert. Co.	19.46	7.96	2.98	1.63	1.90	1.86	3.37	.....	.....	37 98
4	Eureka.....	"	20.08	9.88	2.08	2.80	.80	.81	2.85	.....	.....	40 57
5	Meat Scrap.....	P. J. Crew & Co.	41.75	.....	.....	.....	.....	.....	.....	.....	.....	8 10
6	Anchor Brand Tobacco Fertilizer.....	Southern Fertilizing Co.....	16.64	4.00	3.82	3.89	2.18	2.13	2.40	.....	.....	39 04
7	Goodman's Bone Meal.....	Goodman.....	9.83	.....	.....	31.57	.....	.....	.....	.....	.....	41 01
8	Baldwin's Bone Meal.....	Baldwin & Co.....	14.37	3.65	5.79	2.40	1.35	1.73	2.05	.....	.....	35 14
9	"G. Ober & Son's" "AA".....	G. Ober's Sons & Co.....	13.62	6.14	8.30	1.94	2.68	3.07	2.16	.....	.....	43 00
10	Le & R. Ammoniated Bone.....	Baldwin & Co.....	14.07	12.16	8.82	1.10	.15	.51	.....	.....	.....	83 89
11	L. & R. Ammoniated Super-phosphate.....	Lorentz & Ritter.....	12.16	5.18	8.65	1.63	2.91	2.61	2.05	.....	.....	85 13
12	Alkaline Bone Phosphate.....	John M. Rhodes.....	10.65	8.79	4.61	1.91	3.30	3.68	2.13	.....	.....	84 89
13	Excelsior Peruvian Guano.....	Maryland Fertilizing Co.....	12.37	6.46	4.17	3.96	4.10	2.15	.....	.....	.....	84 51
14	Horner's Raw Bone Meal.....	J. Q. A. Holloway.....	18.31	7.20	4.96	.54	2.07	2.84	6.19	.....	.....	57 68
15	Horner's Dissolved Bone.....	Joshua Horner, Jr., & Sons.....	7.17	.....	.....	.....	.....	.....	.....	.....	.....	44 50
16	Horner's Vulcanite.....	"	9.63	5.44	9.45	6.53	.....	.....	.....	.....	.....	44 65
17	Soluble Sea Island Guano.....	Liebig & Gibbons.....	13.88	.....	.....	.....	.....	.....	.....	.....	.....	39 89
18	B. D. Sea Fowl Guano.....	R. W. L. Ralston & Co.....	10.68	8.84	4.85	2.09	.....	.90	8.85	.....	.....	84 85
19	Champion of Loudoun.....	Bradley Fertilizing Co.....	13.73	7.49	2.16	1.89	.....	.....	.....	.....	.....	87 73
		Eamich & Potterfield.....	7.74	1.15	10.60	1.89	.....	.....	.....	.....	.....	49 39
							5.89	6.45	8.93	.....	.....	

90	Zell's Economizer.....	17.88	7.61	8.43	.98	2.43	3.00	1.44	.....	36.98
91	Piedmont Guano for Wheat.....	13.87	5.57	4.51	1.76	2.17	2.65	2.84	83 00	83 93
92	Plow Brand Raw Bone Super-phosphate.....	10.25	6.85	3.10	2.14	2.18	.93	2.81	83 00	41 50
93	Potomac Guano.....	8.96	4.38	4.53	2.93	3.40	1.68	3.35	.....	49 47
94	Potomac Guano Company.....	9.98	6.56	7.06	2.64	.....	.....	.....	.....	35 80
95	Orchilla Guano.....	8.88	.....	.....	18.94	.19	1.94	.....	.....	18 41
96	May's No. 2 Fertilizer.....	13.80	5.21	4.36	1.75	1.74	2.00	2.63	.....	38 16
97	Bryan's No. 2 Standard Fertilizer.....	10.36	3.20	4.33	1.37	4.13	2.05	2.02	43 00	48 32
98	Golden Grain Pure Bone Fertilizer.....	6.46	3.71	3.69	.69	2.63	3.80	3.13	58 50	46 74
99	Pure Dissolved Raw Bone.....	11.64	8.86	6.15	.....	.58	1.61	3.24	.....	46 57
30	Ammoniated Bone Super-phosphate.....	13.47	7.29	3.43	1.47	1.39	1.76	5.40	.....	50 74
31	Anchor Brand Wheat Fertilizer.....	16.13	3.07	6.70	4.09	1.83	3.25	2.50	.....	36 57
32	Bone and Peruvian Guano.....	11.68	2.94	5.33	.....	3.60	2.69	2.43	41 00	42 43
33	Allison & Addison's Complete Wheat Manure.....	14.06	4.35	3.53	2.09	1.83	2.13	2.43	.....	37 81
34	Ceres.....	11.32	2.46	6.96	3.09	1.46	4.00	1.08	.....	30 73
35	Ronanoke Super-Phosphate.....	14.81	4.93	2.45	8.53	1.81	2.24	1.98	31 50	30 40
36	Acid Phosphate.....	16.73	4.43	6.59	3.39	.....	.....	.....	.....	24 00
37	G. Ober & Son's "AA" Guano.....	12.62	6.14	5.30	1.54	2.63	2.07	3.06	55 00	51 56

* This fertilizer was analyzed on 4th of August, 1881, by sample from Mr. H. S. Field, of Culpeper county, who stated, in a letter accompanying it, that it was taken from a lot used the previous year on his wheat crop. Dr. Taylor got 2.16 per cent. Available Ammonia from that sample. The manufacturer objected to the small amount of Ammonia, and thinking it probable that some of it may have escaped from the remnant of Mr. Field's purchase during the period from seed-time to harvest, I had a sample taken from the store of Mr. Ober's agents here, Messrs. Hill, Stinker and Watkins, which gave 3.06 per cent. of Ammonia, as in this analysis.

The Meat Scrap is sold at \$4 per ton; not as cheap as stable manure, where that can be procured.—(G. A.)

† Mr. Rhodes thinks he is entitled to 5½ to 6 per cent. Soluble Phosphoric Acid, as that amount has been found by other chemists. Dr. Taylor made a second determination, and we can only account for the discrepancy by supposing the two samples may have varied, drawn from different portions of a large bulk. Another sample of this fertilizer gives 3.05 of Soluble, 4.92 of Precipitate, and 2.33 of Insoluble Phosphoric Acid. By this analysis it would be valued at \$40.81.

We give the following analyses ; these of the minerals are partly quantitative and part qualitative, the parties in some instances desiring to know only what the mineral was :

MISCELLANEOUS ANALYSES, 1881.

Craig County Mineral—Silica and Oxide of Iron.

Treasurer Reynolds' Iron Ore—12.57 Metallic Iron.

Floyd County Mineral—Carbonate of Lime and Oxide of Iron.

Mineral (?)—Oxide of Iron.

Amelia County Mineral—Fluor-spar.

Copper Ore (?)—12.48 Copper.

Bedford County Mineral—Silicate of Zinc.

Amelia County Mineral—Touemaline.

Dr. Hatchett's Mineral, Lunenburg County—Potash, 1.28.

Montgomery County Minerals—Quartz.

Fossil Marl, Eamick & Potterfield—Phosphoric Acid, 0.58 ; Potash, 6.69.

Levi Sipe's Mineral—Oxide of Iron.

Stephen Clarke's Mineral, Wytheville—Galena.

William O. Fayer's Limestone, Page County—Carb. Lime, 46.07 ; Carb. Magnesia, 32.24.

J. R. Young, Jr.'s, Poudrette, Norfolk—Ammonia, 1.26.

G. A. Browne's Fish Scrap—Phosphoric Acid, 9.60 ; Ammonia, 8.86.

SHEEP HUSBANDRY

FOR

VIRGINIA.

BY

THOS. POLLARD, A. M., M. D.,

Commissioner of Agriculture of Virginia.

RICHMOND:

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INTRODUCTORY.

The importance of sheep raising in Virginia, the desirability of encouraging it, the inquiries I am having regarding the suitability of Virginia for this industry, with the suggestion of some of the farmers that I should prepare a treatise on the subject, have induced me to present the following pages in the interest of this very important branch of stock raising.

Quite a number of books and essays have been written on "Sheep Husbandry," and it might be supposed that there was no need for any further discussion of the subject. But nothing has as yet been prepared in reference to this important industry for Virginia.

Without intending to play the *role* of critic, we think that few or none of the works that have been prepared on this subject, that we have had an opportunity of examining, are sufficiently practical for the ordinary farmer. We say farmer, because every farmer ought to be a sheep raiser. This, we think, is particularly true in reference to the diseases of sheep, as we shall hereafter show.

In this connection, we desire to acknowledge our indebtedness to "Randall's Sheep Husbandry," "Youatt on Sheep," "Spooner on the Sheep," "Little on Sheep" (the last of whom wrote principally on the mountain sheep farms of Scotland), Dr. Killebrew (Ph. D.) on "Sheep Husbandry for the Farmers of Tennessee," Dr. Hayes (LL. D.) on "Sheep Husbandry for the South," a report on "Sheep Husbandry," prepared by the Department of Agriculture of the United States, in compliance with a resolution of the Senate, June 17, 1878, besides to the "Shepherd's National Journal," published in Chester Hill, Ohio, and the various agricultural journals which, from time to time, have discussed this subject. I have quoted freely from these publications, in some cases making quotations from them, in others using their ideas and statements in my own language.

SHEEP HUSBANDRY FOR VIRGINIA.

ITS ORIGIN, GROWTH, AND PRESENT PROSPECTS.

Stock raising is annually becoming a more important interest, and a more imperative necessity, for Virginia farmers. This necessity is evidenced by the increasing grain crops of the West, with their cheap transportation to the East, making it impossible for our farmers to compete with the fertile and teeming fields of western farmers. Another consideration to be taken into account is the fact that Virginia has for several years been losing ground in competition with western tobacco, and that our farmers are losing money on this crop, unless where they succeed in making the "fancy bright" tobacco. Not the least advantage in stock raising is the improvement of lands, a matter, as every farmer knows, of the greatest importance. It has been said that "more stock means more manure," and more manure means more crops, which in turn enables more stock to be raised, and then more manure, and so on, until the farmer can boast of a rich farm. Of all the stock known, none is more important than sheep, furnishing as it does the food and clothing of so much of the population of the globe—food the healthiest of all that is procurable in large quantities, and clothing that could not be dispensed with in the frigid and temperate regions of the earth, or substituted by anything else. Then, as an improver of lands there is no stock equal to sheep. It has been said that "the hoof of the sheep is golden"; the principal reason of the truth of the proverb existing in the fact that this animal eats coarse grass and weeds and bushes, cleansing the land, appropriating these things to its nutriment, and by its droppings enriching the soil, and by the gentle trampling of the light hoof, causing a great advantage to light and spongy soils.

Sheep are almost as old inhabitants of our territory as the people themselves. They were brought to Jamestown in 1609, two years after the settlement of the Colony by the English. The respective nationalities brought sheep which had been domesticated among them; the English breed was introduced into Virginia, the Spanish into Mexico, the Dutch into New York, &c. The Spanish however were not Merinos, but a coarse wool sheep; the English were very different from the high bred sheep of the present day, being long legged, narrow chested, coarse animals. The lowland sheep of Holland were equally indifferent, and the Spanish were small, agile, of slow maturity, their flesh not being highly esteemed as food, and indeed this was the fact as regards them all.

The progress of sheep breeding was not rapid in Virginia; the animal not being properly appreciated, and indeed there seems for a long time to have been a prejudice against the kind, docile, humble, and useful sheep. Strange as it may seem, John Taylor, of Caroline (Arator), in his popular essays, passed a sweeping

condemnation on sheep, which no doubt helped to engender prejudice against them, and to magnify the difficulty of breeding them; and superadded to this, the abuse bestowed on them by the celebrated and eccentric John Randolph, "of Roanoke," probably aided to increase this prejudice. Even on the floor of Congress he uttered this vehement denunciation against them, "that he would go out of his way at any time 'to kick a sheep.'" His known love for *dogs* very possibly enlisted his feelings against sheep, seemingly taking sides with the prowling dogs against this harmless and greatly useful animal, one of the best friends the human race has. Randolph's predilections for dogs was well illustrated at the time a bill was introduced into Congress to tax them, when he exclaimed, "Mr. President, why tax dogs? Dogs are faithful; men are faithless."

While sheep have been bred in this country and State so long it is only within the present century that improved breeds have been imported, and the old stock improved, with occasional exceptions, as the original Leicesters of General Washington, afterwards called Bakewells, which fared better than some Woburn (we think) hogs sent him from England, which are said to have been stolen by the captain of the ship to whom they were entrusted. The foundation of the improvement which ultimately produced the fine American Merino dates from 1801 and 1802. In 1802 our minister to France, Mr. Livingston, sent home two pairs of Spanish Merinos, which had been modified by a course of breeding of the imperial flock at Chalons, in France. In the same year our minister to Spain, Colonel Humphreys, brought home with him 21 rams and 70 ewes from the best flocks of merinos in Spain, and from these and later importations, by skilful breeding, have been derived the best race of Merinos, said by those capable of judging to be superior to the Spanish and French Merinos. Crossing of these have greatly improved a majority of the flocks of the country, changing the indifferent natives into Merino "grades," in many instances doubling the weight and value of their fleeces.

General Washington collected at Mt. Vernon a variety of fine sheep from England and other countries, and among them a Persian ram, very large, well formed and bearing a coarse wool of great length of fibre. Combined with Leicester blood, a flock was formed which was afterwards considered a distinct breed, called the *Arlington*. It was bred and owned by Mr. Custis, who claimed that some fleeces contained wool fourteen inches long. It was said by Mr. Robert Livingston to have "possessed every ingredient which is esteemed in combing wool, fine for the sort, soft, silky, and beautifully white."

The *Cotswold*, a very popular variety in the South, is of great antiquity, and was imported into this country from England, when we are not advised. The *Southdown*, another English breed, existed for several centuries on the South-Down hills of England. It was imported to Pennsylvania in 1834. The *Leicester*, which was so much improved by Mr. Bakewell, of England, and hence sometimes called *Bakewell*, was imported from England to New York, about thirty-five years since.

The *Shropshire Down* and *Oxford Down* are of comparatively recent origin, but have become very popular. The *Hampshires* are very similar to the *Shropshires*, the shading of the former being a little darker. They are both noted for their mutton qualities, are nearly as large as the *Cotswold*, and shear near the same quantity of wool, which is said to be softer. The *Lincolns*, not much bred in this country, originated in Lincolnshire, England. They are said to be noted for fine-

ness and weight of fleece, and for hardiness and vigor. Of the prominent breeds raised in this country, we have occasion to speak more at length hereafter. It will not be necessary to recur to the last four mentioned except the Oxford Downs.

PRESENT CONDITION AND PROSPECTS OF SHEEP HUSBANDRY IN VIRGINIA.

Though there has been an advance in recent years in sheep culture in Virginia, and in improvement of flocks by the infusion of the blood of improved breeds, the progress has not been what it should be in this important interest. By the census of 1840 Virginia had 1,293,772 sheep. By the census of 1870 we had only 549,000, a decrease to accounted for in a great measure, assuming the census to be correct (of which there is some doubt as regards the census of 1870, which is known to have many defects), by the cutting off of West Virginia from Virginia, and the great destruction of stock during the late war. We have no means of knowing what the reduction of the number was by the separation of West Virginia.

By the census of 1880 the number of sheep in Virginia was 826,776.

England is computed to have one sheep for every one and a quarter acres of land. Suppose we had one for every ten acres. We should then have 2,800,000 (as we have about 28,000,000 acres of land in Virginia), or nearly two millions more than we have now. This, at the moderate estimate of \$2.50 profit on each sheep, would yield a net additional revenue for poor old Virginia of \$5,000,000. This shows the great importance of increasing this industry in Virginia.

In the United Kingdom of England, Ireland and Scotland the number of sheep in 1835 was 32,000,000—not supposed to have varied very much since (*Encyclopedia Americana*); and this with an area not much larger than Virginia. In 1800 England and Wales, not so large as Virginia, had 26,148,463, which was 7,000,000 more than the whole United States had in 1839. These statistics show how many sheep our State is capable of sustaining, and how important it is that we should devote more time and capital to this stock. For a long time sheep raising has played an important part in English husbandry, and the English farmer thinks sheep are all important in the improvement of his land.

Australia furnishes an example to Virginia. We do not know the number of her sheep, but in 1810 the export of wool from Australia and Van Diemens land was 167 pounds, and in 1843 it amounted to 16,226,400 pounds. Most of the States of the Old World have found it to their interest to maintain large flocks of sheep. France, not larger than Virginia, in 1825 had 30,000,000 sheep, since which there has been, it is thought, some diminution from division of landed property and other causes. Spain and many other countries in Europe and Asia, have large flocks. One nobleman, Prince Esterhazy, of Austria, on 7,000 square miles of land has 3,000,000 of sheep. Virginia, with upwards of 40,000 square miles, by this ratio, should have six times that number, or 18,000,000. As we shall show further on, Virginia has advantages for sheep raising equal to these European countries, and probably equal to any other portion of the world.

That the breeding and the quality of the flocks in Virginia has improved in the last decade, we have abundant evidence in the numerous importations of fine bred sheep by a number of intelligent and progressive breeders in Virginia, and by the exhibition of fine sheep at our "State Fairs" from different sections of the State.

We have wool in the State cabinet, of Cotswold raised by General Meem, of Shenandoah, as fine a specimen, we suppose, as any in the world, certainly finer than we have ever seen elsewhere. Also wool from Rev. John E. Massey, from his farm in Albemarle, a mixture of Merino and Cotswold, the pure Lincolnshire, pure Cotswold, and three-fourths Leicester; from W. A. Benton, Loudoun (from a yearling, the fleece weighing $4\frac{1}{2}$ pounds), all of fine quality, much superior to that of the native breeds, the wool of some of which we have also. The fleeces of General Meem have been very heavy, we forget how much. Our collections of wool we are anxious to increase, and preserve as an evidence of our progress in wool raising, and solicit contributions.

SUITABILITY OF VIRGINIA FOR SHEEP RAISING.

In considering this branch of our subject, which is a very important one, reference must be had to the climate, soil, and productions, principally of the grasses, natural and artificial, of the State.

Sheep breeding has been practiced for centuries from the equator to the 65th degree of north latitude, on the burning plains of Africa and Asia, and the frozen region of Iceland, showing how this animal can adapt itself to a great variety of climates. This does not prove, however, that some climates are not better adapted to sheep raising than others. Animals, like men, do better and are more vigorous in temperate latitudes. The winters in Virginia are mild enough to require a very moderate amount of winter feeding, and the summers not so hot as to destroy the growth of grasses and forage plants. The fleece of sheep, as a general rule, becomes finer in cold climates, and coarser in warm ones, but the weight and length is increased in the warm climates by the usual greater abundance of succulent food. But the testimony of the wool-brokers of London (Randall) is that the wool of Australia and Van Dieman's land, between 11° and 42° south latitude, is softer and more silky than that of similar description from Germany. The latitude of Port Jackson in Australia, around which is much sheep breeding, is about $33\frac{1}{2}^{\circ}$ to 34° south latitude. Nashville, Tennessee, is about $37^{\circ} 15'$ north latitude, a little further south than Richmond, which is $37^{\circ} 32'$. Mr. Cockrill, of Nashville, has a flock of about one thousand sheep of fine wool, and about five hundred head of long wooled, or mutton sheep. He says (Randall): "My Saxon sheep were imported in 1824 or '26, I cannot say which, and I find no falling off in quality or quantity of fleece; on the contrary, I believe a little improvement on both points, and a little more yolk* when well provided for, which you know does not abound much in the Saxon breed. The fleeces are a little more compact than formerly, hence more weight, and from our mild climate the *staple has become longer* * * * I have travelled from this place (then he was Mississippi latitude 32° north, where a part of his sheep were kept,) to Boston, sampling all the sheep of note on the way, and I found nothing in my journey, or at Boston, as good as the wool I had grown, and so said all the wool samplers whom I met, and they were not a few. I presumed in reality that the blood of my sheep was no better than many I saw, but the superiority of my wool I ascribed to our climate and the provision for the sheep the year round. The weight of my fleeces is fair, say from 3 to $5\frac{1}{2}$ pounds each." I mention this to show that the latitude of Virginia is not far enough south to affect injuriously the quality of wool. There is no doubt but what, as a

* Unctuous secretion from the skin of the sheep, making the wool soft and pliable.

general rule, the wool of sheep and some other animals becomes finer in cold climates and coarser in warm ones, but the latter effect is not produced until a latitude much further south than Virginia is reached, and indeed from the statement of Mr. Cockrill, it seems that the latitude of Tennessee, and presumably that of Virginia, is adapted to the production of as fine wool as any portion of the United States, other things being equal. It has been found that the quality and quantity of the food has more to do with the quality of the wool than climate, unless it be in excessively hot climates. Youatt says the staple of wool, like every other part of the sheep, must increase in length, or bulk, when the animal has a superabundance of nutriment; on the other hand, the secretion which forms the wool must decrease like every other, when sufficient nourishment is not afforded. When little cold has been experienced in the winter, and vegetation has been scarcely checked, the sheep yield an abundant crop of wool, but the fleece is perceptibly coarser as well as heavier." Dr. Parry, a correct and able English writer, remarks (as quoted by Randall): "Sheep breeders have observed a sort of gross connection between the food and quality of the fleece . . .; the fineness of fleece of a given breed is within certain limits inversely as its fatness . . . A sheep which is fat has usually comparatively coarse wool, and one which is lean, either from want of food or disease, has the finest wool."

ADAPTATION OF TIDEWATER FOR SHEEP RAISING.

We propose to consider the adaptation of the different divisions of Virginia to the industry we are discussing. *Tidewater Virginia*—extending from the head of tidewater to the Atlantic ocean—is penetrated by numerous navigable rivers which empty themselves into Chesapeake bay. It embraces 30 counties, with an area of 11,350 square miles, including 2,500 square miles of valuable tidal waters, being about the size of Maryland or Belgium, which latter has five millions of population, while this portion of Virginia has not much over a third of a million, showing ample room for farmers and their accompanying herds of sheep and other animals. This is a highly favored region, both for men and animals, and while it lacks some of the advantages of Middle, and Piedmont, the Valley, and mountain regions, it has compensating advantages in mildness of climate, cheap living, easy and cheap access to market, dryness of ground in the winter, and comparatively good roads. The lands on the rivers are fertile; those on the plains between the rivers are of light character, easily improved, an abundance of marl being accessible in most of the counties, the use of which generally insures a stand of clover and the grasses. Sheep are known to be healthy in this zone, and the writer, who at one time practiced medicine in Tidewater Virginia, confidently expresses the opinion that it is not to its inhabitants more unhealthy than the other portions of the State. The health of the inhabitants, the tenders and feeders of sheep of course, has a bearing on this industry; if the absurd opinions entertained by some of the unhealthiness of this region were true, then the flocks might suffer for attention in the summer months. For two to three months in the summer of *some* years malarial disease (ague and fever and bilious fever) prevails. Many years the disease does not occur—once (from 1832 to 1842) it was scarcely known, as asserted to the writer by the late Dr. Henry Carter, a distinguished physician of Hanover, Va. When it does occur, *quinine is a perfect antidote*. No one need have more than one or two chills at most before it is arrested by quinine, and the most invet-

crate case of bilious fever in this section may be cured in less than a week by this blessed medicine (*magnum donum dei*) if properly administered. The winters are more healthy in Tidewater than in the mountain and western portion of the State. Typhoid fever is less frequent in Tidewater than in any portion of Virginia. Up to 1851 (the time when the writer ceased to practice there), we believe it did not occur at all in this region; and pneumonia, consumption and rheumatism are decidedly less prevalent in Tidewater than the mountain regions. It has been found that sheep produce as heavy fleeces here as in other portions of the State, and they may be made as fine as elsewhere by proper feeding. They are easily kept, obtaining in a climate so mild a considerable amount of succulent food in the winter. The question will be asked, as this is not a grass region, can summer and winter feed be produced in it at an expense which will make mutton, and wool, and lambs profitable? We think there is no doubt of it. Much of this country, even off the rivers, will produce clover, orchard grass, and red-top or herds grass, and almost all of it may be made to do so by marling or liming, in conjunction with pea-fallow. Mr. Ed. Ruffin, in this connection, says: "Not more than 20 years ago it was a general belief in *Lower Virginia* that the soil was too scanty and the climate too hot to raise red clover. But since marling and liming have made many of these soils calcareous, it is found that neither the sandy soil, nor the hot and dry summers, forbid the raising of excellent and profitable crops of corn." The extent to which these lands may be improved is attested by the present condition of the farm of Mr. John B. Davis, of Richmond, called Lester Manor, in King William county, on the York River railroad, about 30 miles below Richmond. He has brought originally poor and light land to a high state of productiveness, and we have seen growing here most excellent clover. The same may be said of other improved farms in Tidewater. There are native grasses growing in Tidewater of much value; among these are wire grass (*Cynodon Dactylon*) and crab grass (*Panicum Sanguinale*) are most conspicuous. The former is very widespread, hardy, resisting heat, and forming very good grazing for sheep. It is undoubtedly the same as the Bermuda grass, so much prized in the Southern States for its hardiness, productiveness, and nutritious qualities. In the latter States, being a native of tropical climates (said to have been introduced from the West Indies), it grows more vigorously, and attains height sufficient to be mowed, making fine hay in large quantity. A strong doubt being expressed regarding the identity of these two grasses, I obtained from Prof. Stubbs, of the Agricultural College of Alabama, a specimen of Bermuda grass, planted it in my garden, and during the summer sent it with a sample of wire grass to the chemist to the Agricultural Department in Washington; he pronounced them to be the same. viz., "*Cynodon Dactylon*," While this is a very troublesome grass (almost ineradicable) to some crops, it is very valuable for grazing. Hogs are particularly fond of its roots, and almost all other animals will eat these if dug up, and washed to get rid of the dirt. This may be done all through the winter, and the grass will be relished by animals who are deprived of all green food. Mr. Affleck, of Mississippi, (quoted by Randall,) says Bermuda grass well set, which affords the finest and most nutritious pasturage I have ever seen, will keep almost any number of sheep to the acre—three or four times as many as the best "blue grass." Speaking of the difficulty of *extirpation* of this grass, he says it is almost impossible, though it may be easily checked, and weakened enough to grow grain and cotton. To do this, pursue the course of the best Kentucky farmers in their management of a "blue grass" sod. The crab

grass puts up freely in corn fields, and frequently after wheat and oats. In wet seasons like the last the crop is large, and while not making a strong hay, it is easily cured and is freely eaten by stock. The vines of the pea-nut, which is extensively grown in Tidewater, makes an excellent hay for sheep and other stock. They are dug before the vines are injured by frost. The common field pea is much grown in Tidewater, principally to turn under while green as a fertilizer, but the vines can be profitably grown for stock, and make a very nutritious hay, freely eaten by sheep, cattle, and horses, and in no way inferior to clover, if properly cured.

The pea flourishes here under much greater diversities of soil and conditions than in the Northern States, and there seems something specially adapted to the development of this plant in the soils of Tidewater Virginia. Like clover, a leguminous plant, it draws much of its nourishment from the atmosphere, and will grow and flourish where clover and the grasses will perish. Randall says: "For sheep, and particularly for breeding ewes, there is probably no feed in the world equal to nicely cured pea kaulm, with a portion of the seed left unthreshed. It gives them condition and vigor, and enables them to yield a bountiful supply of rich milk to their young." But to fulfill these expectations, it must be cut and carefully cured, so that it will be bright with the leaves looking green, and not having the faded yellow color of over-ripe clover; and if cut greenish, and well-cured, the pods will not thresh out readily, and are in proper condition for breeding ewes with some of the peas left in the hull. If the crop is light, it may be well to cut while the pods are quite green and cure without threshing, and thus feed it all to the ewes. Analyses made by Boussingault show that pea hay is worth as a manure 5 to 9 times as much as the straw from the small grains—is better than clover roots, and is equal to farm yard manure. In this portion of Virginia we are referring to, if rye and winter oats are seeded last of July and first half of August, they may be grazed by sheep in the fall and all mild weather in the winter, and make excellent grazing. Turnips in this region of the State in ordinary winters will live out in the open ground with a slight protection of brush, and the "Seven Top" without any protection, and sheep can be turned on them to feed from the ground as in England. We do not know whether the artichoke has been tried for sheep, but it will produce well in these light lands, and we can see no reason why they will not constitute good food for sheep. I have tried them for hogs and cows, and been well satisfied with the result. They are very productive, will keep perfectly in the ground even with such a winter as we have recently passed through (1880-'81). Analysis proves them to be nearly as nutritious as Irish potatoes—they are more readily kept, and do not, like Irish potatoes, require cooking, and are much more productive. Sweet potatoes are said to be excellent feed for sheep, but in Tidewater the accessibility to market makes this a valuable crop to sell, and it cannot be fed economically to sheep. Fodder corn, which grows so well on the light lands of this region, is another means of feeding and wintering sheep. With the use of *ensilage*, or putting in pits in the green state, a great addition can be made to the feed of all stock in the winter. As much forage can be made from corn as from any other crop, perhaps more. On rich land 40 tons are said to have been raised, and some assert much more. This can be perfectly preserved by the system alluded to, which has been frequently described of late, and food be thus obtained very suitable for sheep in the winter, by adding to it a little meal or corn. The putting away corn fodder in pits need not be more

costly than storing it under sheds or in barns, and there is great difficulty in curing and thus keeping it, and in the feeding of it there is great waste. We found by trial the past year that the cutting of it up may be dispensed with, that if the sides are firm clay soil that boarding or bricking also might be done without, and the packing by mules' or horses' feet was not necessary, but only firm packing and trampling with human feet and heavily weighting with rock or other weight. By this mode the cost will not be more than storing dry fodder, as the greater quantity that can be packed away in pits will pay the expense of digging the pits. We had a good shingle roof and used heavy pressure with large rocks.

The milder winter in Tidewater is a very important consideration in favor of Tidewater for sheep husbandry. The sheep require less food, and can frequently find something to browse on all the winter. Then the milder winter and earlier springs enable sheep raisers to get their lambs to market early, and the accessibility to Northern markets is another advantage this region possesses. As an evidence of the milder winters in Tidewater, the thermometer was at no time in the winter as low as 10° below zero at "Lester Manor," about 25 miles below Richmond. On the 31st of December last the thermometer in the vicinity of Richmond was 15° below zero; however, a most unusual thing, and most of the peaches were killed in the bud, while in portions of Piedmont and the mountain region the trees were much injured. Tidewater is an excellently watered region in every part.

MIDDLE VIRGINIA FOR SHEEP.

Middle Virginia is a high, dry, healthy region, remarkably well watered, with generally a good soil, derived from disintegrated granite, more productive than the lands of Tidewater. The hilly portions have been injured by washings, the result of bad cultivation and bad management, while the lands lying on rivers and creeks are fertile, some of them remarkably so. All the grasses and forage plants which grow in Tidewater flourish here, and clover and the grasses are more easily produced, unless it be Herd's grass or Red top, which on the lower wet lands on the streams of Tidewater finds conditions congenial to its growth. While Middle Virginia is not strictly a grass country, with a little care, and particularly by liming, clover and the grasses are very successfully raised. The climate of this middle zone is mild, and compared with that of the northern States, is more equable, important things in stock raising. Randall says that the range of the thermometer in New York is sometimes 60° to 75° in a single month—March or April—a trying time to the ewes and their lambs. While the natural or the cultivated grasses do not flourish in Middle Virginia as they do in Piedmont and the Valley, the mildness of the climate probably compensates for this, and the fact is well known that sheep prefer short grasses, and that they thrive well on them. Very fine mutton is raised in Middle Virginia; Louisa county particularly has been noted for its fine mutton. And this section, while not so well suited to early lambs as tidewater, still they can be gotten into market at early date, and have been found profitable by those who have devoted attention to them.

There is no doubt but what Tidewater and Middle Virginia are capable of being converted into grazing lands of valuable character by the use of clover and the grasses, and the forage plants mentioned, and by the application of marl and lime, the droppings of sheep, and other cheap manures; and that in these regions wool and mutton and lambs can be produced at less expense than in any part of the United States, north of the Potomac.

PIEDMONT, THE VALLEY AND MOUNTAIN REGIONS.

More probably has been accomplished in these sections in sheep breeding than in any other portion of the State, partly, no doubt, because the people have been generally a more stock-raising people than in other sections, and partly because these are the regular grass lands of Virginia. The only drawback to this interest here is the coldness of the winters and the dampness about the base and sides of the mountains, which no doubt sometimes causes the loss of lambs in weaning time, and which prevents the raising of early lambs for market. This also causes the necessity of more feed in winter, and for a longer time. Compensating advantages to these disadvantages are the fine natural, as well as cultivated grasses, generally to the tops of the mountains too, and the rich grazing all through the summer months. The highest portion of the Blue Ridge in Virginia is the Peaks of Otter, in Bedford, 4,240 feet in height, which is not above the range of the grasses. The mountains in Virginia are usually broad at the base, easy of ascent, rounded or flattened on their tops, generally with rich soil, producing grass and succulent vegetation, fed on by stock, up to the very tops of the mountains, with rarely abrupt precipices or dangerous gorges. In many localities they are cultivated high up on their sides, and frequently to the tops. The Piedmont counties, skirting the eastern base of the Blue Ridge from Maryland to the North Carolina line, and the Valley counties, extending from near the Maryland line to Tennessee, embrace a country of vast resources and great fertility, scarcely equalled, we believe, certainly not surpassed, in natural advantages by any country the sun shines on. The natural grasses and succulent, edible vegetation abound, and clover, timothy, orchard grass, &c., if managed with any care, grow with vigor and in abundance. Where one hundred sheep are raised in this section more than one thousand should be.

So that sheep breeding in Virginia is yet in its infancy; at least it is to be hoped so.

Randall quotes from a communication of Hon. W. L. Goggin (in the *Monthly Journal of Agriculture*), formerly a member of Congress from the district he describes, on the advantages of this section for sheep raising, as follows:

"Bedford, the county in which I reside, is bounded on the south side by the Staunton river, on the north by the James river, while its western extremity, the whole length, reaches the top of the Blue Ridge. . . . The Peaks of Otter* are situated in this county, on the northwest corner—they are not only beautiful themselves, when seen as they are in the distance, but the whole range of the Blue Ridge presents, perhaps, here, the most interesting view of the kind in the State. These mountains afford an unlimited range for stock, and the advantages for sheep-walks (mild as is the climate, combined with the productiveness of the soil) that are nowhere equaled, as is believed, except by similar situations in the neighboring counties. . . . Ranges for sheep may be had at a very reduced price on the mountains, and where, too, could be produced all the grasses in which they delight, such as the Red and White clover, the Meadow Fox-tail, short Blue Meadow-grass, Lucern, Rye-grass, &c. These advantages, and then the beautiful, clear streams which abound in all the mountain regions, invite a pastoral life." Speak-

* The loftiest mountains, as before stated, of Virginia.

ing of Amherst and Nelson counties, he says: "The ranges for stock here, too, are extensive, and the beautiful, rich mountain sides interspersed with farm-houses, some of them even elegant mansions, betoken an independence among the inhabitants that is often found in such situations. Many of the mountains, to their very summits, are covered with the richest verdure." Of Madison and Greene counties, he says: "Here, too, are abundant ranges, and the wonder is that sheep husbandry is not more introduced."

The following on the advantages of Virginia for sheep breeding is from a letter of Hon. Andrew Stevenson, formerly minister to the Court of St. James, to Mr. Skinner:

"Virginia has many advantages for breeding sheep, not surpassed in the United States. The middle part of the State, and especially the whole range of the southwest mountains and Blue Ridge, afford the greatest facilities for fine sheep-walks. Hills covered with fine herbage, extensive inclosures, abundance of running water, and well sheltered by trees against the heat and sun of summers."

Sheep seem to delight in rolling, high lands, and in mountain, hilly land, and to thrive in such localities, and it is said that sheep that are suffered to roam and graze in the mountains produce more wool and of better quality than those raised and grazed altogether on farms. On the mountains of Spain they raise large herds of sheep, and the mountains are said to be sterile in comparison with the rich verdure of our mountains. Besides the natural grasses, Blue grass and others of Piedmont and the Valley regions, and besides Clover and Timothy, Orchard grass is a favorite grass for these regions, growing with great vigor, and in mild winters furnishing grazing much of the winter months. But it will not do to take up the impression that sheep can do in the mountain regions in the winter without feeding, as some have done, with, of course, failure. Sheep, like other animals, require some attention, particularly in severe weather. Many of these mountain lands in Virginia are cheap, and another advantage is that there is a wide range of pasturage, not limited by fences, and virtually free to those who choose to avail themselves of their use. The open woods permit the luxuriant growth of grasses and nutritious herbs throughout the summer, on which numerous herds could be subsisted for eight months in the year without other expense than salting and minding. The soil on the mountain sides is dry and healthy for sheep, and they rarely have any diseases there.

BREEDS OF SHEEP—THE MOST POPULAR KINDS IN VIRGINIA.

The Southdowns, the Cotswolds and Merinos are the most popular breeds in our State. Besides these, we have the "Natives," in some instances not crossed or graded at all; some Lincolns, Bakewells (or new Leicester), Hampshires, Oxforddowns, and Shropshiredowns. Of the latter varieties there are not many, except of the natives, of which we have unfortunately too many. We shall hereafter show the great advantages of crossing upon the common ewe with the best bred bucks, which the farmer will find most suited to his purposes. Properly speaking, there are no "Native" sheep in the State; our ancestors, coming mostly from England, brought the sheep known there at the time of the settlement of the Colony, which, of course, were little improved. Mr. Youatt speaks of the

common sheep of the United States as "although somewhat differing in various districts, consisting chiefly of a coarse kind of Leicester, originally of British breed."

Farmers who undertake to raise sheep must, with care and judgment, select those best suited to their purposes. They must decide whether it is most profitable to raise early lambs, or mutton, or wool, or a combination of them. Which of the breeds will best suit their soil, and its growth, the climate, and attendant conditions, and which will best suit large herds, if sheep are to be kept on a large scale.

SOUTHDOWNS.

This breed has always been popular as a mutton sheep, but formerly furnished wool of only medium quality; but now, by improved breeding but without crossing, and care, their form and size have been much amended, and their early maturity and productiveness increased and the wool so improved that the finer grade is used for combing; still it is deficient in felting properties, and makes a "fuzzy," hairy cloth, and is but little used unless admixed with other wool, even for the lowest class of cloths. It is used for balzes and flannels in a large way. This is a very old breed, and existed for many years in the chalky hills of England known as Southdown, from which they take their names. They are of medium size, round, compact in form, with dark colored legs and faces, the wool being of medium length. Their fleece averages from three to four pounds, but this breed is cultivated more particularly for its mutton, in which it excels all others. They mature early, are industrious feeders, take on fat readily and evenly over the whole body, are prolific breeders, and good mothers. It is said that one hundred ewes may be relied on to produce one hundred lambs—twins occurring as often as barren ewes. Though originally an upland sheep, they adapt themselves well to all sections, and are well established in popular favor. They are turned off at two years old, and the weight at that time is from eighty to one hundred pounds, and high fed wethers have reached as much as forty pounds to the quarter. The Down is healthy and hardy, will stand exposure and hard stocking, and will subsist on rough feed and short pastures; no sheep better, notwithstanding American winters; strong items in their favor. It is quiet and not disposed to rove, though an industrious feeder. It crosses better with short and middle wool breeds and common ewes than the Leicester, a cross with the latter being very desirable. Experienced breeders say that lambs from the Southdown cross are worth 75 cents to \$1 more than lambs by common rams. This breed has been introduced into every part of the United States and the various countries of Europe. Youatt says the Emperor of Russia paid Mr. Ellman, the founder of the improved breed of Southdowns, three hundred guineas for two rams (a long time since, we suppose), and that in 1800 a Southdown ram belonging to the Duke of Bedford was let for one season at eighty guineas.

THE COTSWOLD.

This is a large breed of sheep, with long and abundant wool. Before improved by modern crosses they were a very large, coarse, long-legged, flat-ribbed variety, with long, heavy, coarse fleeces. They were deficient in early maturity, and did not possess feeding qualities equal to some other breeds. To a cross with the new

Leicester we owe the modern improved Cotswold. The fleece on an average weighs seven to ten pounds, and the carcass slaughtered one to two hundred pounds, and sometimes more. They stand first for the excellency and quality of combing wool, it being strong and soft, from six to eight inches in length. It has not the fineness nor the lustre of the Leicester, qualities wanted for black mohair and brillante fabrics; still this breed has almost superseded the Leicester, because it is hardier, the Leicester not standing well the northern climate. On good pastures the Cotswold takes on flesh quickly, but do not distribute it evenly as do the Southdowns, nor do they "marble" their flesh like the latter. The ewes are usually good milkers and prolific breeders, the lambs being large, well formed and hardy, but are thought not to fatten so rapidly from the start as the Southdowns. As mutton they are not equal to this latter breed. A cross of the Cotswold ram upon the common ewes of the country has been very beneficial, not only increasing the size and form of the native, but sometimes trebling the weight of the fleece. On this account particularly they are very valuable for those who desire to combine, as far as possible, both fleece and mutton qualities. They are rather unwieldy and not as industrious feeders as Merinos, and hence are not so well adapted to the hilly, mountainous and broken regions of Virginia, and even to the hot sun and more or less scant pastures in the summer of Middle and Tidewater. To succeed best they must have level pastures and cool climate. But by systematic and contined course of breeding with the common ewes excellent results may be reached, and with only several removes a sheep closely resembling Cotswold, with a heavy fleece, and well adapted to our southern climate and undulating lands of Middle and Piedmont Virginia, and the Valley, may be obtained. Indeed, the pure Cotswold does well in Piedmont and the Valley and mountain regions. In Shenandoah county, General Meem raised splendid specimens of this breed, as we saw them at one of his sales several years since, and we have now in the State Cabinet samples of the wool of his Cotswold, as we have said, probably equal to any "long wool" in the world.

Spooner, an English writer, gives the following description of this breed :

"The Cotswold is a large breed of sheep, with a long and abundant fleece, and the ewes are very prolific and good nurses. Formerly they were bred only on the hills, and fattened in the valleys of the Severn and the Thames; but with the inclosure of the Cotswold Hills and the improvement of their cultivation they have been reared and fattened in the same district. They have been extensively crossed with the Leicester sheep, by which their size and fleece have been somewhat diminished, but their carcasses considerably improved, and their maturity rendered earlier. The wethers are now sometimes fattened at fourteen months old, when they weigh from fifteen to twenty-four pounds per quarter, and at two years old increase to twenty or thirty pounds. The wool is strong, mellow, and of good color, though rather coarse, six to eight inches in length, and seven to eight pounds per fleece. The superior hardihood of the improved Cotswold over the Leicester, and their adaptation to common treatment, together with the prolific nature of the ewes and their abundance of milk, have rendered them in many places rivals of the new Leicester, and have obtained for them, of late years, more attention to their selection and general treatment, under which management still farther improvements appears very probable. They have also been used in crossing other breeds, and, as before noticed, have been mixed with the Hampshire

Downs. It is, indeed, the improved Cotswold that, under the term new or improved Oxfordshire sheep, are so frequently the successful candidates for prizes offered for the best long-wooled sheep at some of the principal agricultural meetings or shows in the Kingdom. The quality of the mutton is considered superior to that of the Leicester, the tallow being less abundant, with a larger development of muscle or flesh. We may, therefore, regard this breed as one of established reputation, and extending itself throughout every district in the Kingdom."

This is a noble-looking sheep, with good figure, a large head well set on, a broad chest, well-rounded base, and straight back.

THE MERINO.

This is one of the most valuable, if not the most so, of all the breeds of sheep. In appearance, it is the most indifferent. With its small body, rendered more so to the sight by its short wool, its large, ponderous horns, with drooping head and humble face, with the loose skin hanging from the necks covered with spiral rolls of wool, oily, and besmeared with dirt, the superficial and inexperienced observer is accustomed to look with contempt upon this superbly useful animal. Their wool is long, fine and soft, twisted into glossy, spiral ringlets, but covered naturally as it is with oil, which collects dust and other impurities, it presents the appearance of inferiority, but on parting it the rich treasure is revealed, and its unsullied purity and fineness is exhibited to the astonished gaze of those uninitiated in the mysteries of Merino wools.

This breed has long been known in the United States, and has been improved here so that to-day the American Merino is regarded as the equal, if not the superior, of any other Merino. The first importation of them into the United States took place in 1801; in that year four were shipped to New York, and a pair to Massachusetts, but of the former only one survived the passage. In 1802, Mr. Livingston, American Minister to France, shipped two pair to his estate on the Hudson, and in the same year Mr. Humphreys, our Spanish Minister, shipped 200 to the United States; and later, in 1809, 1810, and 1811, Mr. Jarvis, American Consul at Lisbon, sent home large and valuable flocks. Since that time the importations have been frequent. They attracted little notice until our difficulties with England led to a cessation of commerce with that power from 1808 to 1812. The Merino then rose into importance, the attention of the country being called to the necessity of wool growing and manufacturing. So great was the interest excited in this matter that from a thousand to fourteen hundred dollars apiece were paid for the Merino sheep. But unfortunately with some of the latter importations, sheep were brought in the worst condition, arriving with those scourges—scab and foot rot. These evils and the increased supply soon brought the price down to less than a twentieth part of their former value. When, however, it was established by experience that their wool did not deteriorate in this country, as had been feared, and that they were readily acclimated, they again rose rapidly in popularity, but the prostration of our manufactories which soon after followed rendered the Merinos of comparatively little value and ruined some who had purchased at previous high prices. But the rise in fine wool which has since taken place has caused this breed to keep pace in value, and they are now in high estimation and are raised in large herds in different parts of the country, particularly

in the North and West, and more especially on the Pacific slope and on the islands belonging to this coast and that of Mexico. "This breed, though a native of a warm climate, becomes readily inured to great extremes of cold, flourishing in the extreme Northern States of Europe without degeneration. It is a docile, patient animal, adapting itself to almost all circumstances and conditions. Accurately conducted experiments show that it consumes a little over two pounds of hay per day in winter; the Leicester consumes from $3\frac{1}{2}$ to four pounds, and the common American about 3 pounds. The mutton of the Merino, in spite of the prejudice against it, is fine grained and of good flavor when killed at a proper age, and weighs from 10 to 14 pounds per quarter. This breed is remarkable for its longevity, retaining its teeth, and continuing to breed two or three years longer than the common sheep and about six years longer than the improved English breeds, but it must be remembered it is correspondingly slow in arriving at maturity. It does not attain its full growth before three years old, and the ewes in the best managed flocks are rarely permitted to breed before they reach that age" (Youatt). The Merino is a far better breeder than any other fine-wooled sheep, and the lambs, when newly dropped, though looking weak for a few days, are said to be harder than the Bakewell, and as much so as the high bred Southdowns, though the ewe is not so good a nurse as the latter, and will not usually carry more than one lamb properly. Eighty or ninety per cent. is about the ordinary number of lambs usually reared, though sometimes it reaches 100 per cent. in carefully managed or in small flocks. As above noticed, the Merino is noted for its longevity, and it is equally noted for its health and hardiness, being more hardy than any other improved breed. They are thrifty on uplands and lowlands, in cold or warm climates, and on scant or luxuriant pasture. Under all circumstances, and in all climates, they are known for their fine fleece and hardy constitutions, enabling them to herd in larger numbers than any other variety without injury or danger to the health of the flock. These qualities they transmit to their offspring to a great extent, and for this reason they are the most valuable to cross upon the common sheep of the country. A prominent fact in connection with the propagation of this breed in the United States is that they have been improved somewhat in size and in the fineness of their fleece. Mr. Youatt describes Merino wool (Negreth fleece) raised, we suppose, in England, as being "very fine, being only 1-750 part of an inch in diameter." Dr. Emmons, editor of the "American Quarterly Journal of Agriculture," measured the diameter of Mr. Randall's wool by microscope and found it 1-1800 of an inch in diameter. This shows very forcibly the improvement which has been made in America on the Merino wool of Spain. Dr. Emmons found also that the American Merino wool is not only the finest, but that its strength is greater in proportion to its diameter. As to weight of fleece, that has been improved in the United States and in Europe. The Merinos of Rambouillet in France, as stated in the report of M. Gilbert to the National Institute,* taking rams and ewes together, averaged 8 pounds to the fleece unwashed, deducting the tags and wool of the belly, which are sold separately. But from the manner of folding and housing them in France, and feeding on fallows, they are very dirty, and the fleece loses 60 per cent. in washing, which would bring the average down to about 4 pounds. Randall mentions a ram and ewe of his raising (American Merinos), the fleece of the former of which, at 13 months, weighed 8 pounds of well washed wool, and when three years the weight was 10 to 12 pounds

* Quoted by Mr. Livingston (Randall).

washed wool; the ewe sheared 7 to 8 pounds of well washed wool. The United States Commissioner of Agriculture, in his report in answer to Senate resolution in 1878, requesting information on sheep husbandry in the South, says it is not unusual for the fleece of the improved Merino ram to weigh 30 pounds and scour 8. The Merino has improved much in Europe as well as in this country. The report just mentioned says: "The improvement has been great in each country, and the tendency invariably in the same direction—compactness of carcass, greater size and weight, and fleece of longer but not finer fibre. The French is the heaviest, with fleece of longer, coarser fibre. The American is bred for compactness of frame, hardiness, a dense and heavy fleece of medium length and fineness, and has been improving constantly for the past twenty years." The shape and general appearance of the Merino is familiar to all breeders of sheep. In the best bred Merinos the skin is loose, mellow, and of rich, delicate pink color; a colorless skin, or one of tawny appearance, indicates bad breeding. The large, deep folds on the neck, wool of long, firm, fine texture, the short thick head, face free from wool, small ears, straight hind legs, and broad loins, mark the well bred Merino. On the subject of wrinkles, there is some difference of opinion. Certain it is, that it is objectionable to have them in excess, as it makes them much more difficult to shear, and gives too much appearance of deformity.

Randall says: "Though I once entertained a different opinion, the steelyards have satisfied me that an exceedingly wrinkled neck adds but little to the weight of the fleece—not enough to compensate for the deformity and the great impediment which it places in the way of the shearer. I have owned lambs, the labor of shearing six of which, in a nice and workmanlike manner, cutting the wool off short and smooth, on and among the multitude of folks and wrinkles, was fully equivalent to shearing fifteen ordinary Merino rams or twenty-five ewes—that is to say, the work of a man for a day. And none but a skilful shearer could, with *any* time given him, clip the wool short and smooth among the wrinkles without frequently and severely cutting the skin. A smoothly drawn skin and absence of all dewlap, on the other hand, would not perhaps be desirable." (We scarcely think such a sheep could be Merino.—C. A.) Many have contended that more wool can be obtained from a wrinkled skin, as it affords a larger surface, and this view has induced the Spanish and French breeders to endeavor to increase and extend these wrinkles, the latter to an extreme degree.

Randall goes on to say: "The wool of the Merino should densely cover the whole body, where it can possibly grow, from a point between and a little below the eyes, and well upon the cheeks, to the knees and hocks. Short wool may show, particularly in young animals, on the legs, even below the knees and hocks, but long wool covering the legs, and on the nose, below the eyes, is unsightly, without value, and on the face it frequently impedes the sight of the animal, causing it to be in a state of perpetual alarm, and disqualifying it to escape real danger. Neither is this useless wool, as seems to be thought by some, the slightest indication of a heavy fleece. I have often seen it on the Saxon scarcely shearing 2 pounds of wool, and on the very lightest fleeced Merinos.

"The amount of *gum* which the wool should exhibit is another of the mooted points. Here, as in many other particulars, experience has changed my earlier impressions. Merino wool should be yolky, or 'oily,' prior to washing, though not to that extreme extent, giving it the appearance of being saturated with grease, occasionally witnessed. The extreme tips of the wool may exhibit a suf-

ficient trace of gum to give the fleece a darkish cast, particularly in the ram, but a dark, pitchy gum, resembling semi-hardened tar, extending an eighth or quarter of an inch into the fleece, and which *cannot be removed in ordinary washing*, is, in my opinion, decidedly objectionable. There is a white or yellowish concrete gum not removable by common washing, which appears in the *interior* of some fleeces, which is equally objectionable. The weight of fleece remaining the same, medium length of staple with compactness is preferable to long open wool, inasmuch as it constitutes a better safeguard against the inclemencies of weather and better protects the sheep from the bad effects of cold and drenching rains in spring and fall. The wool should be as nearly as possible of even length and thickness over the whole body; shortness on the flank and shortness or thinness on the belly are serious defects. 'Evenness of fleece' is a point of first importance. Many sheep exhibit good wool on the shoulder and side, while it is far coarser and even hairy on the thighs, dewlap, &c. Rams of this stamp should not be bred from by any one aiming to establish a superior fine wool flock, and all such ewes should be gradually excluded from those selected for breeding."

Randall gives the following points in describing of the Merino :

"The shape and general appearance of the Merino should be as follows: The head should be well carried up, and in the ewe hornless. It would be better on many accounts to have the ram also hornless, but, being usually characteristic of the Merino, many prefer to see them. The face should be shortish, broad between the eyes, the nose pointed, and in the ewe fine and free from wrinkles. The eye should be bright, moderately prominent, and gentle in its expression. The neck should be straight (not curving downward), short, round, stout—particularly so at its junction with the shoulder, forward of the upper point of which it should not sink below the level of the back. The points of the shoulder should not rise to any perceptible extent above the level of the back. The back, to the hips, should be straight," &c.

A great point in favor of the Merino is its capability of bearing cold, probably better than any other breed. In the "Shepherd's National Journal," (recently established at Chester Hill, Ohio—Vol. I, No. 1,) a writer, J. L. H. (no doubt John L. Hayes, Secretary of the National Association of Wool Manufacturers), we find an interesting article on "Wool Growing in Montana Territory." The writer says "It must still be observed that the mercury in some districts occupied by flocks has been known in exceptional cases to descend as low as 40° F. below zero. This occasional severe cold is found to have no unfavorable effect upon the hardy Merinos, the kind usually grown, protected as they are by their dense fleece, with its impenetrable coating of yolk—cemented wool. Severity of winter seems to be but a slight obstacle to sheep raising, if it does not prevent access to pasturage by causing deep and long lying snows." This pasturage is the bunch and buffalo grass, particularly the former, which stretch in thick and even carpets through and over the mountains for hundreds of miles, and curing in the dry pure atmosphere furnish a food for cattle and sheep summer and winter unrivalled by any forage. As another evidence of the hardiness of this breed, it is further stated: "A provision of sheds is desirable in winter against severe storms, but in Montana they rarely receive hay or other food save that gathered by themselves." It must be remembered that Montana is considered one of the best grazing countries in the

world. Further: "In the extreme cold weather of 1874-'75, Messrs. Davenport and Ray, prominent wool growers, wintered 3,500 sheep on Sun river *without any sheds*. Although the mercury at one time indicated a temperature of 40° below zero, something almost unparalleled in Montana, they lost only 26 head of sheep out of the 3,500, and 14 of these were killed by a shepherd dog in his vigorous efforts at keeping the band (flock) together in a severe storm." There must be something exceptional in this climate, probably due to dryness and uniformity of temperature, such as we are told prevails in Minnesota.

As an indication of the preference altogether for a milder climate and the advantages of Virginia in this respect for sheep raising, we find very considerable losses have occurred both in sheep and lambs during the past severe winter. In the "Shepherd's Journal," referred to, we see it stated that "in the West, in some instances, where pastoral sheep husbandry has been pursued, 25, 50, and 75 per cent. of flocks were lost from the severity of the winter and lack of feed upon the ranges. Also loss of lambs is recorded particularly in Ohio; some correspondents claim that the lack of milk and loss of lambs is greater and more general than they have ever known. They attribute this to the fact that the ewes have not had sufficient exercise and green feed during the winter, the abundance of snow preventing the ewes from procuring any portion of their winter feed from the fields, and they have continued near the sheds. The lambs became weak and sick when one or two days old, and died in three to six days from time of yearning." Another correspondent says the losses have been immense, and are not yet wholly apparent, as lambing time has not yet come nor the shortening of the wool clip duly considered, &c.

These are the three principal breeds reared in Virginia. We have a few Leicester, Lincoln, Oxfordshiredown, Shropshiredowns, and perhaps some Hampshires. The Leicester, or Bakewell (called so from Mr. Bakewell, an Englishman, who much improved the breed), were early introduced into the State, and were very popular, but seem now to have about disappeared from the State, giving place to the Cotswold, with its heavier carcass, and larger fleece, and greater hardiness. Still there are breeders who think very highly of the Leicester. Dr. Williams, of North Carolina, a correspondent of Colonel Killebrew, in his "Sheep Husbandry," says: "In Tennessee to-day, for general purposes, the Leicester is unsurpassed, if not unequaled, by any other breed of sheep. Compared with the different breeds of fine wool sheep they are larger and yield more wool, which is worth more per pound. Possessing a good constitution, they fatten as well as the Southdown, have a heavier carcass, a heavier fleece of wool, worth more per pound. They are not so large as the magnificent Cotswold, but surpass them in symmetry of form, in constitution, which insures them a long life, and in the texture of the fleece. The ewes are good breeders and good nurses. They very often produce twins, and the twins grow off as well as the single lambs, which are sought for by breeders and butchers at liberal prices. The wool has been sold in the Nashville market during the last twelve years for from 25 cents to 65 cents per pound as taken from the sheep, and averaging from six to eight pounds each fleece, and in some individual cases as high as twelve and even fifteen pounds. The wool is strictly combing wool, and is used by manufacturers in making the finest blankets, and other articles requiring a long, fine fibre. . . The heads of the Leicesters should be small and hornless, the ears long, the legs short, and clean of wool, usually of a dusky tinge with occasionally small black spots on

them, the neck small, the brisket deep, the body long and round, the back broad, and the hind quarters square. Dressed in their winter suit, the neck is well protected with the Elizabethian ruffle, and their bodies covered with a soft coat of long, wavy, combing wool which the March winds toss about like billows."

The Leicester is a lowland sheep, and requires good pasturage, and is not suited to the cold northern portions of this country, not being so hardy as the Cotswold. It is a favorite sheep in England, where it can obtain rich, green, tender feed, and where the winters are comparatively mild. Virginia is not too cold for the Leicester, and it would very probably prove a profitable sheep here. The Leicester has more fineness of wool than the Cotswold, and has the luster required for mohair, worsted and brillante fabrics. It has not been in so much demand heretofore in this country because of the want of worsted fabrics, but from the experience in the Nashville market just mentioned seems to be growing in demand.* While as mutton it does not "marble" its flesh as do the Southdowns, intermixing its fat and lean, and is usually too fat for the American taste, in England it is much esteemed, particularly among the working classes, and is in great demand for its flesh. Mr. John L. Hayes (Sheep Husbandry in the South) says: "The Leicester is the most valuable of all mutton sheep for crossing, and imparts its precocity, that is, its capacity for fattening in one year, and of reaching full growth in two years, and therefore its mutton-producing capacity to all other races. Where there are rich, sweet pastures, with quantity in a small space, and a moderate climate, the Leicester will thrive." This breed attained so much popularity in England that very high prices have been paid for them. Mr. Bakewell, who so greatly improved it that it was called "Bakewell," let out his buck "Two Pounder" for the enormous price of 400 guineas (\$2,000) for a single season. The new Leicester has spread into all parts of the British Dominions, and has been imported into Europe and the United States.

THE IMPROVED KENTUCKY SHEEP.

This breed was established by Mr. Robert W. Scott, of Frankfort, Kentucky, and if what is said of it is true, should receive more attention from the farmers in Virginia. In a communication made to Colonel Killebrew he says: "None of the previously existing breeds seemed to possess all the requirements of sheep for the great West and South; the native sheep were inferior in carcass and fleece; the Cotswold were too delicate, especially when young, and their fleeces too open to bear exposure to our wet seasons; the fleece of the Southdowns was too short, and the Merinos was too small. Acting on these impressions, the writer has perseveringly endeavored for over forty-six years to combine in the same animal the hardiness and prolific quality of the native sheep, the size and weight of the fleece of the Cotswold, and the symmetry of form and delicacy of mutton of the Southdown, and also to combine in the same fleeces the weight and length of the Cotswold, with the thickness and softness of the Merino. My success has been so great and the sale and diffusion of the sheep have been so wide that I am gratified at having been able to give, through the popular report of the Agricultural Department for 1865, the following history of the improvement."

Mr. Scott then goes on to tell how the improvement and the establishment of

* We have in the State Cabinet a very handsome specimen of this wool from Mr. W. H. Benton, of Loudoun county, Virginia, medium in length.

the new breed were accomplished. He first crossed the unimproved or native ewes with a fine Saxony, or Merino ram, then the ewe lambs of this cross with an imported Southdown buck, then on these with a three-fourths Cotswold and one-fourth Southdown, then with pure bred Cotswold ram, then with full blooded Oxfordshire. "In the fall of 1853 the flock was divided between two fine, full blooded Cotswold rams. . . In 1855 I bred chiefly to a mixed blooded ram whose pedigree showed Cotswold, Oxfordshire, Teeswater and Southdown blood (a very fine animal). . . In 1856 I bred chiefly to a large and fine Cotswold, and in 1857 to him and to a ram of mixed blood, the ewes being so selected and bred as to produce a more complete uniformity in the progeny—those having a predominance of Southdown and Merino being bred to Cotswold, and those having a predominance of Cotswold qualities being bred to the mixed blooded ram. In 1858 two large and fine rams of my own breeding were used in the same manner, and for the same object chiefly, viz., to give uniformity and stability to the flock. A few ewes were also bred in 1858 to a very fine mixed blood ram, which was a perfect model of symmetry, and which had taken a premium at the State Fair in Louisville in that year. In October, 1857, the flock of about one hundred ewes was again selected and bred with a view to the same object, about one half being bred to the above premium animal and the remainder to a fine 'Improved Kentucky' sheep, which had a fleece of remarkable length, fineness of fibre, and was of good size and form. By this time these sheep were essentially alike and uniform, maintained their identity and imparted qualities as surely as sheep of any other breed. They had been exhibited with success at many State and county fairs, and had been sold to almost every State in the South and West, including California; and all which I could raise from a flock of about one hundred found ready sale at the uniform price of \$30 each for those one year old and under.

"In a country which is comparatively new, and in which stock raising is conducted on an extensive scale, housing in winter is necessarily expensive and troublesome, and it is impracticable except with those animals which are valuable and very delicate. . . Indeed, it is doubtful whether any breed of sheep which requires housing in winter can become a generally popular and practically successful breed in the West and South. . . . The 'Improved Kentucky' sheep (that is the name by which they have been long and widely known) have always faced the bleakest winters and the hottest and driest summers without any protection, except that which nature has given them, and yet they have been almost entirely free from all diseases, especially from the cough which often in winter affect other sheep; and they have been equally free from the 'snuffles' and 'foot rot,' which have been so fatal to other breeds.

"In springs, winters and summers of excessive rains, clothed to the knees and to the ears by a thick, long, and impenetrable fleece, they bid defiance to the wind, rain, and snow, and seem at all times to be comfortable and sprightly. In summer they are changed from pasture to pasture, and devour almost every green weed. In winter, short grass is all they require; and if that cannot be afforded them, they will take their corn-fodder with the cattle, and thrive well upon it, though at lambing time, like other sheep, they require a more succulent diet. My stock sheep have never been fed with grain at any time, and when in winter they have been admitted to a hay-stack, they have seemed to prefer the corn-fodder.

"Only the most healthy, finely-formed, and well-wooled ewes are kept as breeders; and the utmost care has been taken, and no reasonable expense has

been spared, to secure rams to breed to them of a similar character, and which would impart some superior qualities to the flock ; and no ram has ever been used with any, even the slightest, taint of disease upon him. In this manner, and by frequent crosses with animals which were not even remotely related to each other (except in the cases and for the purposes above stated), and also by crossing with rams of different breeds, without making violent crosses, a degree of health and vigor has been infused into this breed which, I feel assured, is not surpassed, if indeed it is equalled, in any other. So great is their tendency to take on flesh and fat, that ewes which lose their lambs not unfrequently become, on grass alone, too fat to breed ; and in several instances I have seen fully three inches of fat on the ribs, after being dressed for mutton, though fed on grass only.

"As to their prolific character, native ewes, under favorable circumstances, very frequently, if not most commonly, have twins, and being good nurses, generally raise them well. Notwithstanding the accidents to which they are liable in the absence of a regular shepherd, and despite the rigors of winter endured without shelter, I have often, when the flock of this breed of sheep was smaller than at present, raised one-third more lambs than there were ewes, and have rarely failed to raise as many lambs as ewes even under unfavorable circumstances."

Colonel Scott, after saying that very large sheep are not desirable, continues :

"None of these sheep have ever been fully fatted, and their weights carefully noted, within my knowledge ; but a few years since, I sold sixteen wethers of this breed to a sheep-dealer and farmer, at fifteen dollars per head, and he wrote me : 'I sold them at twenty-five dollars per head, and the person I sold them to did well with them. They took the premium over a fine lot of Cotswold wethers. I consider them better than the Cotswold for mutton and wool, and think they feed more kindly than any sheep I ever saw. They were pronounced by all, the best sheep in the market.' I extract from my sheep register the following weights of some of them taken in the month of August : A yearling ram, 174 pounds ; a two-year old ram never shorn, 224 pounds ; a grown ewe, 162 pounds ; a ewe lamb, 114 pounds ; all weighed off of grass, without extra keeping of any kind.

"The fleeces of these sheep vary from eight to fifteen, and in one instance seventeen and a half pounds, the whole flock of over one hundred breeding ewes having averaged over eight pounds of merchantable wool, free from burs, tags, &c. ; and though not washed on the sheep's back, still clean enough for domestic manufacture. Though the fleece of these sheep (like those of all other breeds) are not perfectly uniform as to length, thickness, and fineness of fibre, still there is a general uniformity, and the diversity is of no practical disadvantage. Their wool is longer than that of any sheep, except those of the Cotswold family, and is equal in length to that of many individuals of that family, while it greatly excels the wool of the Cotswold in fineness and softness of fibre, and in the number of fibres to the square inch on the sheep's back. In some individuals it is wavy or curly, but it is never harsh or wiry. Except the face and the legs below the knees, the whole body is covered with a close and compact fleece, which, when full grown, leaves no open line on the back, as with the Cotswold, but gives a perfect protection to the sheep, and causes them to present a smooth, handsome, and portly appearance. Their fleeces have enough of grease and gum to preserve the softness and vitality of the fibres, even to their ends, but not so much as to give

the sheep a dark and dirty appearance. Their wool receives domestic dyes without any washing whatever, is easily cleaned on the sheep's back, and when it is washed in soft water, with soap, it readily becomes very white, receives chemical dyes, and preserves its lustre perfectly. It has generally commanded from three to five cents per pound more than any other best combing wool in the markets of the vicinity; and I desire to refer to the opinions of several extensive and intelligent manufacturers who have bought it frequently. Mr. L. C. Stedman, of Georgetown, says: 'As regards the wool of your sheep, I think very highly of it, being strong and well adapted to our use for domestic purposes; cards and spins well, and makes a good strong fabric.' Mr. J. W. Martin, of Midway, says: 'It is in all respects superior wool, and peculiarly adapted to the manufacture of jeans and linseys, and we have paid more per pound for it than for any other wool.' Mr. S. L. Brownell (an extensive and experienced manufacturer of Louisville) says: 'I noticed particularly its working qualities, and believe that no cross of wool could be effected that would improve its working character. It seems to have length, strength, and texture, and at the same time firmness, fineness, and softness of staple, which render it peculiarly adapted to the southern and western manufacture and wear.'

"Mr. Joseph Gorbut, of Woodford county, says: 'I can and do with pleasure say, that we prefer the wool of your Improved Kentucky sheep to that of any other we have ever used. When we take into consideration the fineness of the texture, the length and evenness of the staple, the weight of the fleece, its clearness of gum (losing less in scouring than any other of any kind), we can say that we prefer the wool purchased of you to any other we use; and in consequence have for years recommended our customers to supply themselves with your Improved Kentucky sheep.'"

We have introduced this much about this breed because we think it ought to be tried in Virginia on account of its hardiness, superior quality of its wool, its good mutton qualities, and its prolific character.

There are some other breeds occasionally seen in Virginia and worthy of mention, viz., *Oxforddowns*, *Shropshiredowns*, *Hampshires*, and *Lincolns*. We had an opportunity of seeing good specimens of these breeds at the "International Exhibition of Sheep, Wool, and Wool Products," held in Philadelphia last September. The *Oxfords* were well represented in this exhibition as regards quality, and, to my unpracticed eye, they seemed the best sheep on the grounds; and such, I know, was the opinion of others who were good judges—farmers who were old breeders of sheep. This was formerly regarded as a cross breed, and it was not until 1857 that they were given a distinctive name by a convention of breeders. Their size and fleece partake more of the long wool.

They were originally produced by crossing a Hampshire or Southdown ewe with a Cotswold ram, and then putting the crosses together; the former was most commonly used, as it gave increased size. By close attention and selections, a sheep has been produced of distinct characteristics, hardy constitution, large frame, good fleece, aptitude to fatten, and superior as mutton. This breed was thus established in Oxfordshire, about twenty-five years ago. The *Oxforddown* has a dark color, the head well covered with wool, with a top knot on the forehead, a good fleece of wool, a well-formed barrel, short, dark legs, with good, firm flesh. They are said to stand close stocking and confinement. Mr. T. S. Cooper was

the only exhibitor of this breed; his collection was the admiration of every judge of sheep, and were really conceded to be the finest on exhibition. They were of fine size, admirable proportions, with fine woolled bodies. The famous imported ram Freeland headed the collection. At the Centennial he gained the grand sweepstake prize as the best ram of any age in the middle wool class, weighing more than any sheep at the exhibition, viz., 425 pounds. At present he is said to weigh only 300 pounds, though apparently in fine order and health, and is certainly a splendid animal.

The Lincolns, not very much bred in this country, originated in Lincolnshire, England, made a good show, and attracted considerable attention. They are said to be noted for the fineness and weight of fleece, and for hardiness and vigor. They are considerably like the Cotswold, and, it is contended, will shear as much and as good quality wool. They have a dotted or mottled ear. They had two exhibitors, Mr. Wade and Mr. Martin, of Pennsylvania. The former had a fine ram, four years old, weighing 250 pounds, and an ewe weighing 240 pounds. In Mr. Martin's collection were ten ewes imported from England. These sheep have wool of extraordinary length and texture.

The Shropshires and Hampshires were also on exhibition. The former, called also Shropshiredowns or Shrops, are said to be unsurpassed for mutton, to be very hardy, thriving well on ordinary pastures, yielding about the same amount of wool as Cotswold, but somewhat softer; they are nearly as large as the Cotswold. They originated from an old breed in England, black or brown, and sometimes spotted face, horned sheep. These were crossed with Cotswold, Leicester and Southdowns; the horns have been bred out, but they retain their colored faces and legs. The Hampshires differ but little from the Shropshires, the shading of the former being a little darker. Mr. Homewood, of Delaware, was the only exhibitor of these breeds. Their appearance was very prepossessing.

I have described these breeds as I saw them at this exhibition and according to the information obtained there, because they are not generally familiar to the Virginia farmers. The wool of the Lincoln, raised and furnished by Hon. John E. Massey, already referred to, is of excellent quality, with fine, tough fibre, not so long as the Cotswold. His crosses of one-fourth Merino on Lincoln or Cotswold (he was not certain which) are finer and shorter than the first, and the crosses of one-half Merino on Cotswold or Lincoln are still finer and shorter.

BREEDS TO BE PREFERRED.

This will depend on the locality, the natural surrounding circumstances, and the object the breeder has in view, whether for mutton, wool, or early lambs, or a combination of these objects. In selecting a breed for any given locality, we must take into consideration the feed, the climate, the market facilities, and demand. No one race combines the highest perfection in all points; for while one is distinguished for its mutton, another for early maturity, another will be in demand for its wool-producing qualities, and there can be no "general purpose" sheep. If the farmer has rich lowland herbage in a climate where it will remain green most of the year; if he is convenient to markets where mutton finds a prompt and profitable sale; then mutton, and not wool, should be the prominent object. Still incidental advantages must also be considered. Under such circumstances, the Cotswold, the Southdown, New Leicester, Oxforddown, and perhaps

the Improved Kentucky, must be decided between. If we wish to keep large flocks, the Downs will herd much better than the two larger breeds, and they will better endure occasional short feeding, caused by droughts of summer and deficiency of winter feed; and if there is demand for mutton of the best quality, the Down possesses superiority over all others. But if few are kept in the same enclosure, and if the pastures be wet or marshy, the larger breeds will better live and thrive on the rank herbage growing in such situations; and while the mutton they furnish is not of so fine a quality, they possess an earlier maturity, particularly the Leicester, and will give more meat and suet in proportion to the amount of food consumed.

The value of the wool, no matter for what purpose sheep are bred, is an important consideration, though it may not be a principal object in the culture of any of these breeds, and helps to determine their relative profitableness. The New Leicester yields about 6 pounds of long, coarse, combing wool, the Cotswold rather more, Southdown 3 to 4 pounds of inferior quality of carding wool. The Long Wools are not adapted to short herbage of Middle and Tidewater Virginia; and therefore are best adapted to Piedmont, the Valley, and mountain regions. Small flocks of them succeed in the former sections, if well attended to and fed on the artificial grasses and forage plants. But the New Leicesters, and New Oxfordshire (or Oxforddowns), and Cotswold, produce mutton of gross, fat quality, not acceptable to persons of refined taste, and not available for feeding colored laborers on, who would rarely be willing to substitute it for their bacon, and will not find any considerable market off the farms. To feed on the poorer soils, sustain larger herding, and furnish mutton for the better class, the Southdown is a great desideratum for Eastern Virginia. It will live and thrive where the Long Wools will dwindle away, though it must not be supposed they will live and thrive properly on very poor lands with scant herbage. The large Long Wools are valuable to cross on the common stock in Eastern Virginia to procure early lambs, which find a quick transportation and ready sale in Northern markets; and for this purpose, the farmers in this section will find it profitable to keep a well bred pure ram of the New Leicester, Cotswold, Lincoln, or Oxforddown—the former particularly being noted for early maturity. Should we increase our stock of sheep as should be done, there are not good facilities for marketing large quantities of mutton, unless we could rival the celebrated Kentucky mutton, which is much sought after by the wealthy residents of Northern cities. This could not be done by the farmers of Middle and Tidewater, but we see no reason why it may not be accomplished in Piedmont and the Valley, in those portions accessible to Northern markets; and railroad transportation is now being so rapidly extended that we hope the time will soon come when every part of these sections will have convenient markets. For Middle and Tidewater, the prominent objects should seem then to breed for early lambs and wool, and for the other portions of the State for wool and mutton. Wool is important for all the sections, it being so easily transportable, and can be profitably grown where there is not much accessibility to market. Where the facilities are such as to enable the farmers to market early and large lambs, then the larger breeds of Long Wools will combine this requisite, with that of the production of the Long Combing Wools, now in so great demand for worsted manufacture. The worsted manufacture of this country ten years ago amounted to \$10,000,000, and now it is more than \$20,000,000. The profitable production of Long Combing Wools is limited, in a great

measure, to populous districts, where there is demand for mutton and where there are good grasses. Mr. John L. Hayes quotes from Col. Rich'd Peters, of Georgia (high authority), who says the more elevated country of the Southern States is well adapted to long wooled sheep. Mr. Hayes says: "A milder climate than that of the North is required for the successful culture of the most important of the long-wooled English races, the Leicester, and therefore the hardier Cotswold are preferred. . . The wool of the Cotswold is too coarse for many worsted fabrics, and has neither the fineness nor the lustre of the Leicester. Greater fineness in the Cotswold fleece may be produced, as has been done in Kentucky and Tennessee, by a slight infusion of Merino blood; but the highly important quality of lustre, such as is wanted for the so-called black mohair and brilliant fabrics, can be imparted only by Leicester or Lincoln blood."

In comparing breeds of sheep for wool growing, the question is not which breed will produce the heaviest and best fleeces regardless of production for cost of feed and attention, and every other expense must be considered in testing the profits of particular animals. The true point is what breed from an acre of land will produce the greatest value of wool. There is no evidence that *breed* by itself considered has any influence on the quantity of food consumed; the consumption must, as a general rule, be in proportion to the weight of the grown animal." Randall says that "Spooner states that grown sheep take up $3\frac{1}{2}$ per cent. of their weight in what is equivalent to dry hay to keep in store condition. Veit places the consumption at $2\frac{1}{2}$ per cent. My experience would incline me to place it midway between the two. But whatever the precise amount of consumption, if it is proportioned to the weight, it follows that if an acre is capable of sustaining three Merinos weighing 100 pounds each, it will sustain but two Leicesters weighing 150 pounds each, and two and two-fifths Southdowns weighing 125 pounds each. Merinos of this weight often shear 5 pounds per fleece, taking the flock through. The herbage of an acre then would give 15 pounds of Merino wool, and but 12 pounds of Leicester, and but 9 3-5 pounds of Southdown (estimating the latter as high as 4 pounds per fleece). Even the finest and lightest fleeced sheep, ordinarily known as Merinos, average about 4 pounds to the fleece, so that the feed of an acre would produce as much of the highest quality of wool, sold under the name of Merino, as it would of New Leicester, and more than it would of Southdown. The former would be worth from 50 to 100 per cent. more per pound than either of the latter. Nor does this indicate all the actual difference, as I have in the preceding estimate placed the live weight of the English breeds low and that of the Merino high. The live weight of the four-pound fine fleeced Merino does not exceed 90 pounds. It ranges from 80 to 90 pounds, so that 300 pounds of live weight would give a still greater product of wool per acre. I consider it perfectly safe to say that *the herbage of an acre will give uniformly nearly double the value of Merino that it will of any of the English Long or Middle Wools.*"

Randall says, "The important question now remains, What are the *other* relative expenses of these breeds? I speak from experience when I say that the Leicester* is in no respect a hardier sheep than the Merino—indeed, it is my firm conviction that it is *less hardy*, under the most favorable circumstances. It is more subject to colds, and I think its constitution breaks up more readily under disease. The lambs are more liable to perish from exposure to cold, when newly dropped. Under *unfa-*

*I speak of full blood Leicesters. Some of its crosses are much hardier than the pure bred sheep.

avorable circumstances—herded in large flocks, pinched for feed, or subjected to long journeys—its capacity to endure, and its ability to rally from the effects of such drawbacks, do not compare with those of the Merino. The high-bred Southdown, though considerably less hardy than the unimproved parent stock, is still fairly entitled to the appellation of a hardy animal. In this respect I consider it just about on a par with the Merino. I do not think, however, it will bear as hard stocking as the latter, without a rapid diminution in size and quality. If the peculiar merits of the animal are to be taken into account in determining the expenses—and I think they should be—the superior facundity of the Southdown is a point in its favor, as well for a wool-producing as a mutton sheep. The Southdown ewe not only frequently yeans twin lambs, as do both the Merino and Leicester, but she possesses, unlike the latter, nursing properties to do justice by them. But this advantage is fully counterbalanced by the superior longevity of the Merino. All the English mutton breeds begin to rapidly deteriorate in amount of wool, capacity to fatten, and in general vigor, at about 5 years old; and their early maturity is no offset to this, in a sheep kept for wool-growing purposes. This early decay would require earlier and more rapid slaughter or sale than would always be economically convenient, or even possible, in a region situated in all respects like the South. It is well, on properly stocked farms, to slaughter or turn off the Merino wether at four or five years old, to make room for the breeding stock; but he will not particularly deteriorate, and he will richly pay the way with his fleece, for several years longer. Breeding ewes are rarely turned off before *eight*, and are frequently kept until *ten* years old, at which period they exhibit no greater marks of age than do the Down and Leicester at *five* or *six*. I have known instances of Merino ewes breeding uniformly until fifteen years old! The Improved Cotswold is said to be hardier than the Leicester; but I have said less of this variety, throughout this entire letter, as from their great size* and the consequent amount of food consumed by them, and the other necessary incidents connected with the breeding of so large animals, the idea of their being introduced as a *wool-growing sheep* anywhere, and particularly on lands grassed like those of the South, is, in my judgment, utterly preposterous. There is one advantage which all the coarse races of sheep have over the Merino. Either because their hoofs do not grow long and turn under from the sides, as do those of the Merino, and thus hold dirt and filth in constant contact with the foot, the coarse races are less subject to the visitations of the hoof-ail, and, when contracted, it spreads with less violence and malignity among them. Taking all the circumstances connected with the peculiar management of each race, and all the incidents, exigencies, and risks of the husbandry of each fairly into account, I am fully convinced that the expenses, other than those of feed, are not smaller *per capita*, or even in the number required to stock an acre, in either of the English breeds above referred to, than in the Merino. Nor should I be disposed to concede even equality, in these respects, to either of those English breeds, excepting the Southdown.”

Many southern farmers, seeing that the South needs a much larger proportion of coarse than of fine wool for her own consumption, and that they furnish wool for so great a portion of the woollens consumed in the South, have, in many instances, come to the conclusion that coarse wools can be most profitably grown by them. But the coarse wools do not bear so good a price as the fine ones, and

* I saw two at the late New York State Fair, at Saratoga, which weighed over 300 pounds each.

It has been demonstrated that it does not cost any more to raise a pound of fine wool than of coarse wool, and indeed a pound of *medium* Merino wool can be raised more cheaply than a pound of the Southdown, Leicester, or Cotswool. This Randall seems clearly to have established. Because the South requires more of coarse wool than of fine it does not follow it should raise coarse wool. Raise fine wool, sell it for a higher price and buy coarse wool, or coarse woollen fabrics. But Randall says even for plantation use, for slave cloths, fine wool is worth more, pound for pound, than coarse wool for actual wear and use; and he says he challenges the fullest investigation, through the testimony of those familiar with the subject or through the direct ordeal of experiment. He says that "broadcloth, it is true, is not so strong nor will wear as well as Chelmsford plain, of treble thickness. The threads of the former are spun to extreme fineness to economize the costly raw material . . . these threads are still further reduced by "jigging" and shearing. But spin fine wool into yarn as coarse as that use in Chelmsfords, and manufacture it in the same way, and it would make a far stronger and more durable cloth; the reasons are obvious. Merino wool is decidedly stronger and more durable than the English coarse, and long and middle wools, or any other coarse wools in proportion—in proportion to its diameter and bulk. It felts far better, and therefore there is a greater cohesion between the different fibres of the same thread, and between the different threads. It is more pliable and elastic, and consequently less subject to "breaking and abrasion." There seems to be no doubt that it is to the Merino that the *wool grower* must look to as the most profitable sheep. It is supposed by some that as mutton it is very inferior, and that it is only fit for wool growing. On this point, Randall says: "As a mutton sheep it is inferior to some of those breeds, but not so much as it is generally reputed to be. If required to consume the *fat and lean together* many who have never tasted Merino mutton, and who have an unfavorably impression of it, would, I suspect, find it more palatable than the luscious and over fat new Leicester. The mutton of the cross between the Merino and native sheep would certainly be preferred to the Leicester by anybody but an English laborer used to the latter. It is short grained, tender, and of good flavor. The same is true of the crosses with the English varieties. . . . Grade Merino wethers, say half-bloods, are favorites with the northern drover and butcher. They are of good size, extraordinarily heavy for their apparent bulk, make good mutton, tallow well, and their pelts from the greater weight of wool on them, command an extra price. They would, in my opinion, furnish a mutton every way suitable for plantation consumption, and one which would be well accepted in the southern markets." Some persons suppose that the meat of the Merino has a certain disagreeable "wooly" taste, very objectionable, but this taste will not be perceptible if the pelt and viscera are removed with all possible dispatch as soon as the animal is slaughtered. In addition to this, the animal should not have been overheated previous to butchering.

Colonel Killebrew (Sheep Husbandry) says: "The Merino has many advantages; though smaller, it is remarkable for vigorous health, and for *tenderness and juiciness* of its meat, and when once tried will find many to advocate its claims." Mr. William G. Markham, president of the New York State Wool-Growers Association, and secretary of the National Wool-Growers Association, says of this breed: "In introducing sheep husbandry in the South, where wool is the main object and mutton an auxiliary, the most profitable sheep to breed is unquestion-

ably the type I have described, resulting from a cross of American Merino upon the native sheep of the land. In the vicinity of large towns, where early lambs or mutton may be more profitably grown, the Cotswold should be used upon the second or third cross of Merinos upon natives; the Cotswold being more hardy than any of our mutton sheep, and yet not as hardy as the resultant cross with Merinos. In whatever line one is breeding, the *sheep* is of first consideration; second, take care of the *sheep*, and you make a success" (Sheep Husbandry by John L. Hayes). When Improved Kentucky and other choicé mutton sells for six cents per pound, the Merino will sell for about four cents per pound; but the greater profit in their wool and their superior adaptation to upland pastures in large flocks will compensate for this. The Merino is not so prolific as some other breeds, and will not do justice to more than one lamb. Their lambs are said to be as hardy as the Southdowns, but the ewes not so good nurses, and do not rear more than eighty or ninety per cent. of lambs, though sometimes in carefully managed or small flocks it reaches one hundred per cent. But this defect is fully counterbalanced by the greater longevity of the Merinos, and thus their longer production of wool, the early maturity of other breeds being no offset to this when kept for wool-growing purposes. Under the influence of the high protective tariffs of 1828 to 1832 Saxon and Merino fine wools were greatly raised. The "Compromise Tariff" of 1833 and other tariffs gradually reduced these duties, and under this influence of the revulsion of 1837 wool went down nearly fifty per cent. The tariff of 1842 raised the duty on wool, but still the growers of fine wool could not sell it at first cost, and the manufacturers, from some unknown cause, would not make the proper discrimination between Saxon and Merino, and coarse and grade wools. In some cases, for instance, medium wool, the fleece weighing four pounds, would bring 25 cents per pound, or \$1; and the Saxon and Merino, the fleece weighing two and a half pounds, would bring 30 cents per pound, or 75 cents. The consequence of this was that the growers of fine wool commenced to give up their costly and carefully nursed flocks, as the tariff of 1842 was giving them no relief; and the example becoming contagious, some gave up the rearing of sheep altogether, while many crossed with coarse wooled sheep, some with English mutton breeds, while some more judiciously went back to the parent Merino stock, usually selecting the heaviest and coarsest wooled Merinos, thus deteriorating the character of wool; and as the preceding period had been distinguished for its passion for fine wool, this was characterized by a mania for *heavy fleeces*. The English crosses however were soon given up, and the Merino regained his popularity so long lost, and was generally adopted by those commencing flocks in the West. Still fine wool has decreased and coarse wool proportionally increased, and manufacturers now see the necessity of making a juster discrimination in prices, which they are doing. Otherwise they must get their fine wool by paying an import duty of thirty per cent., which they cannot afford to do and compete with English manufacturers, who pay an import duty of two pence per pound. The manufacture of fine cloths is increasing in the country, and consequently the demand for fine wools. It has been complained that manufacturers are not even now paying fair or liberal prices for fine wool, and it has been suggested that if they do not do so that the raisers of this wool should co-operate and withhold their wool from the manufacturers one season, but such co-operation is hard to secure, and if secured produces bad feeling and attempted retaliation oftentimes.

Randall classifies wool as follows: "*Superfine*, the choicest quality of wool grown in the United States, and never grown here except in comparatively small quantities; *fine*, good ordinary Saxon; *good medium*, the highest quality of wool usually known in the market as merino; *medium*, ordinary Merino; *ordinary*, grade Merino and perhaps selected Southdown fleeces; *coarse*, the English long wools. This sub-division is not minute enough by any means to express fully the number of well-defined classes which exist in wool."

The South, including Virginia, has great advantage over the North in the growth of superfine and fine wools. Dr. Randall says: "The climate north of 41°, or beyond all dispute 42°, is too severe for any variety of sheep *commonly known* which bear either of these classes of wool. In fact, the only such variety in any thing like general use, is the Saxon, and this is a delicate sheep, entirely incapable of safely withstanding our northern winters without good shelter, good and regularly administered food, and careful and skilful management in all other particulars." After speaking of the difficulty of rearing their lambs, and that in the northeast or northwest storms that come driving down with snow or sleet on its wings, or where there is a sudden depression of the temperature from any cause, no care will save multitudes of lambs from perishing, he says, "a few large sheep-holders whose farms, buildings, etc., have been arranged with exclusive reference to the rearing of these sheep, may continue to grow fine wool *until driven from it by the competition of the South*; but many of these have recently adopted a Merino cross." Many of the northern farmers have taken a deep aversion to the Saxon sheep. Mr. John L. Hayes, in his book, recommends the culture of *Electoral* wools in the South. He means those derived from the Saxon breed. He says: "We refer to the exceedingly fine Electoral wools, such as were formerly produced by the old Saxon sheep, and at present by the Silesian sheep of the same or a very similar race. They are still cultivated to a limited extent in Silesia, Hungary, and Poland, which countries produce all the superfine wools used in Europe. The few wools of this class used here are imported from these countries at enormous prices. Fashion, invariably revolving in great circles, always repeats herself in time. Superfine broadcloths and other tissues demanding the finest fibre, will again be in vogue. The electoral wools will secure prices as they have never yet done, proportionate to their high cost of production. On account of the delicacy of the animals producing them these wools cannot be successfully grown at the North, as we know personally from observation on the paternal farm in Maine, where their culture was formerly attempted with the utmost energy, but with such poor results as to cause its abandonment. In the mild climate of the South their successful culture is assured beyond all question. This is proved by the letter last quoted.

Mr. Watts, of South Carolina, in his communication elsewhere given at length, says: "I have now on my table a Silesian wool measuring say 1,800 hairs to the inch, which cost the consumer here \$1.50 in gold per pound. With none of the ridiculously extreme care which the European growers of the Electoral wool exercise in their flocks, Mark Cockerill, of Tennessee (near Nashville), has raised Saxony wool of a fineness of 2,000 hairs to the inch, and could sell it at a handsome profit at \$1 per pound. In fact, Mr. Cockerill claims there is more margin for profit in it than in the growth of more ordinary wool. These wools are designated in Germany as *Noble* wools. . . . Two Hungarian princes competed with each other on exhibits of Noble wools at our Centennial Exhibition." Fine

wools, no doubt, can be successfully raised in Virginia, and at least we should turn our attention to good medium upward, instead of the lower classes; and it is a question whether for this purpose we should raise the Saxon or Merino. The latter is every way a hardier animal and a better mother; it is heavier by about twenty pounds, and of course consumes more food; but this is more than compensated by the additional care and husbandry necessary for the Saxon. As a general thing, the Saxon will raise the finest wool, but sometimes the heavy fleece Merino will equal, and, indeed, occasionally surpass the Saxon in fineness. During the *fine wool mania*, those who sought fine wool bred the Saxons, or crossed with it, and those who stood up for the Merino usually aimed to distinguish it as much as possible from the Saxon, by increasing the weight of fleece in disregard of the fineness, and as a result few of our breeders, until recently, sought a high degree of fineness in breeding the Merino. Recent experience, Dr. Randall says, has satisfied him that this is rapidly attainable. He quotes Mr. Lawrence, a large Massachusetts manufacturer, as saying in a letter to him: "I believe a breed may be raised which will give 4 pounds of exquisitely fine wool to the fleece," and Dr. Randall says: "I know by multiplied experiments that once inter-breedings between an ewe bearing good medium wool (the fleece weighing say from 4½ to 5 pounds) with a Merino ram of sufficiently high quality, will produce wool in the offspring equalling ordinary Saxon, and a fleece averaging 4 pounds, with none of the weight made up of *gum*. The result of two such inter-breedings will bring the progeny of a heavy-fleeced medium ewe (provided her fleece is properly *even*) to the same point. The four-pound, fine-fleeced Merino would be far more profitable animal than the Saxon, other things being equal." But other things are not equal, hardiness, rearing lambs, &c., as we have stated. A cross has been recommended between the Saxon and the Merino with the view of getting a four-pound, fine-fleeced sheep, but the objection to this is of the same character as breeding full blood Saxon—that of the probable production of a delicate and poor nursing sheep. Some have tried crossing the Saxon on the common ewe, but it shortens the wool of the common sheep, already too short, without adding much to the thickness, and the fleece remains a light one. But these objections do not exist in a cross between the Merino and the common sheep. On the other hand, the wool is but little shortened, unless that of the common sheep was very long; is decidedly thickened, is made to extend over the belly, and the fleece is therefore greatly increased in weight; the sheep itself is rendered more compact in body, with shortened legs. This is an excellent sheep for ordinary farmers who expect most profit from the wool, and is very popular over the northern States—probably preferred by a majority of sheep raisers there. By increasing the Merino crosses two or three more times a first-class wool-growing sheep is obtained, scarcely inferior in any respect to the full-blooded Merino, except for breeding purposes. The Merino rams to breed from should be selected with care, and should be obtained from breeders of known skill and reliability. The ram should weigh from 120 to 150 pounds, and yield of wool about five per cent. of his carcass. A very large or very small animal should be avoided, as they are not apt to be so hardy as the medium sheep, and when large the fleece is not usually so fine. Dr. Randall gives these points of the Merino as those to be desired:

"The shape and general appearance of the Merino should be as follows: "The head should be well carried up, and in the ewe hornless. It would be better on many accounts to have the ram also hornless, but, being usually characteristic of

the Merino, many prefer to see them. The face should be shortish, broad between the eyes, the nose pointed, and in the ewe fine and free from wrinkles. The eye should be bright, moderately prominent, and gentle in its expression. The neck should be straight (not curving downward), short, round, stout—particularly so at its junction with the shoulder, forward of the upper point of which it should not sink below the level of the back. The points of the shoulder should not rise to any perceptible extent above the level of the back. The back, to the hips, should be straight, &c.

"Though I once entertained a different opinion, the steel-yards have satisfied me that an exceedingly wrinkled neck does not add but a little to the weight of the fleece—not enough to compensate for the deformity, and the great impediment which in places in the way of the shearer. I have owned rams, the labor of shearing six of which, in a nice and workmanlike manner—cutting the wool off short and smooth, on and among the multitude of folds and wrinkles—was fully equivalent to shearing fifteen ordinary Merino rams, or twenty-five ewes—that is to say, a day's work for one man. And none but a skillful shearer could, with *any* time given him, clip the wool short and smooth among the wrinkles, without frequently and severely cutting the skin. A smoothly drawn skin, and absence of all dewlap, on the other hand, would not, perhaps, be desirable.

"The wool of the Merino should densely cover the whole body, where it can possibly grow, from a point between and a little below the eyes, and well up on the cheeks, to the knees and hocks. Short wool may show, particularly in young animals, on the legs, even below the knees and hocks—but long wool covering the legs, and on the nose below the eyes, is unsightly—without value—and on the faces it frequently impedes the sight of the animal, causing it to be in a state of perpetual alarm, and disqualifying it to escape real danger. Neither is this useless wool, as seems to be thought by some, the slightest indication of a heavy fleece. I have as often seen it on Saxons scarcely shearing two pounds of wool, and on the very lightest fleeced Merinos.

"The amount of *gum* which the wool should exhibit is another of the mooted points. Here, as in many other particulars, experience has changed my earlier impressions. Merino wool should be yolkly or "oily," prior to washing—though not to that extreme extent, giving it the appearance of being saturated with grease, occasionally witnessed. The extreme tips of the wool may exhibit a sufficient trace of gum to give the fleece a darkish cast—particularly in the ram—but a black, pitchy gum, resembling semi-hardened tar, extending an eighth or a quarter of an inch into the fleece, and which *cannot be removed in ordinary washing*, is, in my opinion, decidedly objectionable. There is a white or yellowish *concrete* gum, not removable by common washing, which appears in the *interior* of some fleeces, which is equally objectionable.

"The weight of fleece remaining the same, medium length of staple, with compactness, is preferable to long, open wool, inasmuch as it constitutes a better safeguard from inclemencies of weather, and better protects the sheep from the bad effects of cold and drenching rains in spring and fall. The wool should be as nearly as possible of even length and thickness over the whole body. Shortness on the flank, and shortness or thinness on the belly are serious defects.

"'Evenness of fleece' is a point of the first importance. Many sheep exhibit good wool on the shoulder and side, while it is far coarser and even hairy on the thighs, dewlap, &c. Rams of this stamp should not be bred from by any one

aiming to establish a superior fine-wooled flock, and all such ewes should be gradually excluded from those selected for breeding.

"The 'style of the wool' is a point of much consequence as mere fineness. Some very fine wool is stiff and the fibres almost straight, like hair. It has a dry, *cottony* look. This is a poor, unsaleable article, however fine the fibre. Softness of wool—a delicate, silky, highly elastic feel, between the fingers or on the lips, is the first thing to look after. This is usually an index, or inseparable attendant, of the other good qualities, so that an experienced judge can decide, with little difficulty, between the quality of two fleeces, in the *dark*! Wool should be finely serrated or crimped from one extremity to the other—i. e., it should present a regular series of minute curves, and, generally, the greater the number of these curves in a given length, the higher the quality of wool in all other particulars. The wool should open on the back of the sheep in *connected masses*, instead of breaking up into little round spiral ringlets of the size of a pipe-stem, which indicate thinness of fleece; and when the wool is pressed open each way with the hands, it should be dense enough to conceal all but a delicate rose-colored line of skin. The interior of the wool should be a pure, glittering white, with a lustre and 'liveliness' of look not surpassed in the best silk.

"The points in the *form* of the Merino which the breeder is called upon particularly to eschew, are a long, thin head, narrow between the eyes; a thin, long neck, arching downward before the shoulders; bad crops, back falling behind the shoulders, narrow loin, flat ribs; steep, narrow hind quarters, long legs, thighs scarcely meeting at all, legs drawn far under the body at the least approach of cold. All these points were separately or conjointly illustrated in many of the Saxon flocks which have been recently swept from the country. The points to be avoided in the fleece have been sufficiently adverted to."

We think this standard is rather overdrawn, as most standards for animals are. Not many Merinos carry "the head well up," nor do we think they are a "highly symmetrical sheep."

For *mutton*, the Southdown takes precedence of all others. As before stated, they mature early, are industrious feeders, not much disposed to roam, fatten easily, marbling their fat, and disposing it evenly over the surface, are prolific breeders, and good mothers. For mutton purposes, they are very valuable to cross upon the common ewes of the country, both on account of mutton and also on account of the lambs. The Cotswold have much merit also as mutton sheep; they take on flesh quickly if on good pastures, but do not distribute it evenly like the Southdowns, nor do they distribute the fat amongst the lean meat ("marble" their flesh) as do the Southdowns. The "Kentucky Sheep" and the "Improved Kentucky," established by Mr. Scott, of that State, rank high as mutton sheep; Kentucky mutton invariably appears in the choice *menus* of the popular hotels at the North, and its consumption is enormous in Northern cities. There are said to be stalls in Faneuil Hall Market where nothing is sold but Kentucky mutton. The Leicester mutton is too fat, and the fat and lean too little intermixed, to suit American taste. In England, where the laboring classes consume much mutton, the meat of the Leicester is in great demand, and the fine feeding qualities which this sheep possesses render it a popular favorite with the breeder. This breed when freely fed is unrivalled for its fattening properties and early maturity; this is particularly the case with them on the rich herbage of the highly cultivated lands of England. It has been found useful in crossing with common ewes to

impart its fattening qualities and early maturity, both for mutton and lamb. But it must be remembered that the Leicester requires fine pasturage, and that its place is on the luxuriant herbage of lowlands. The "Oxford Downs," or the "Improved Oxfordshire," which Spooner says is only the improved Cotswold, makes mutton which is considered superior to that of the Leicester, the tallow being less abundant, with a larger development of muscle or flesh. The Lincolns, the Shropshiredowns, and Hampshires probably rank about with Cotswold as mutton sheep. The question for us to decide is whether we are surrounded by circumstances which will make these large breeds profitable for mutton. Our long, hot, often dry summers, so unlike those of England, leave the grass too short for the heavy, sluggish long wools, particularly if flock are kept in any numbers.

The above remarks do not apply equally to the Southdowns, because it will thrive where the long wools will become poor; but even the Southdown, to make good mutton, must have good pasturage, for they cannot attain proper weight on poor and scant herbage. The old, unimproved Southdowns would rough it quite successfully on light and thin soils, but the modern Southdowns have been bred to fulfill the requisites of a mutton sheep in size and quality, and require that additional food which the formation of additional fat and muscle demand. Better bred animals with their improved organs make a better appropriation of food, and require more of it, and of better nutritive value to arrive at anything like perfection, and large animals require more food than small ones. But in Piedmont and the Valley, and the Mountain region, the long wools find the rich herbage and flourishing grasses which they require, and in these regions fine specimens of long wools have, of late years, been raised. Much of this region has been heretofore too removed from markets to enable the farmers to market large quantities of mutton; but now that railroads are penetrating everywhere through Virginia, it will not be a long time before facilities will be afforded of transporting mutton rapidly and with comparative cheapness to Eastern and Northern markets. The use of mutton as food should be encouraged, for there is scarcely any meat so healthy. On this account, and on the score of economy, we should endeavor to substitute a portion of mutton for the bacon now so extensively used on the farm. Matter of taste is much influenced by custom, and almost every one would come to like this meat if it was used habitually. If our laborers had had mutton given them in the early history of the country by this time they would probably as much prefer it to bacon as they now do bacon to mutton.

Fattening sheep for mutton must be well attend to by those who expect to put fine mutton on the market. The flock should be separated, putting the different grades together—the older sheep together, the growing sheep together, the ewes who have been suckling lambs, rams who have been serving ewes, each separately. Colonel Killebrew gives the following experiments made by Dr. Voehler, of England, as a sort of guide for giving the proper quantity and quality of different kinds of food:

"He fed four sheep seven weeks and they consumed 196 pounds clover hay, 49 pounds linseed oil-cake, 3,743 pounds mangel-wurtzels, which gave a daily ration to each animal of 1 pound clover hay, 4 ounces oil-cake, and 19½ pounds mangels. The nutritive elements contained in this daily ration, according to our table, was 4½ ounces flesh formers, 53½ ounces fat formers, and 4½ ounces of mineral matters. Here is the effect:

	Weight at commencement.	At end of seven weeks.	Gain of each in weight.
No. 1.....	153 pounds.	170½ pounds.	17½ pounds.
No. 2.....	134 “	151½ “	17½ “
No. 3.....	170 “	187 “	17 “
No. 4.....	135 “	155 “	20 “

“Each sheep gained on an average one pound in three days, or one pound for every fifty-six pounds of food consumed; or for every sixty-two ounces of dry matter contained in the food. It has been demonstrated by frequent experiment that 100 pounds of roots fed in a yard with shelters will give one pound of live weight to the sheep, or if fed in open pasture without protection it will require 150 pounds to produce the same result, or one-third more, and this relative proportion will hold with regard to all other kinds of feeding. If one and one-half pounds of oil-cake is given daily, the increase is two pounds for every 100 pounds of roots, which shows that four and one-half pounds of oil-cake will make one pound of mutton. When peas, beans and hay were fed with the roots it was found that eight pounds of the mixed grain would make one pound increase in weight, and oats fed with roots shows that seven pounds of oats, with the same quantity of roots as fed before, will give one pound of increase. Six pounds of barley would produce the same result. Messrs. Lawes and Gilbert in the course of experiments, established the fact, that to produce 100 pounds of mutton it was necessary to feed 272½ pounds of oil-cake, 252½ pounds clover hay, and 3,753 pounds of roots (rutabagas). These experiments are recorded in the Journal of the Royal Agricultural Society. In summing up, they, taking into consideration the various conditions of the animals, the varying value of the feed and its quality, and all the circumstances of disturbance and repose in which a flock may be kept, came to the conclusion that, to produce one pound of flesh, it would be necessary to feed the following substances under a shelter, as it would require an addition of one-half of each food to attain the same result in the open pasture. This calculation, too, is based upon the idea of their being no other food in reach. It is as follows:

Rutabagas fed under cover.....	100 pounds.
Good clover hay.....	12 “
Beans or peas.....	8 “
Oats.....	7 “
Barley.....	6 “
Linseed oil-cake meal.....	6 “
Linseed oil-cake meal and peas mixed.....	4½ “

“Now, the last item in this case shows curiously enough the value of mixed food. Of the oil cake it requires six pounds to produce one of flesh, and of peas it requires eight pounds, yet mix the two together, and it only takes four and a half pound, or three-fourths of the quantity when mixed.

“Turnips are more commonly raised for sheep food than any other root crop, but it is the result only of habit, and it is time the old rut should be abandoned and a new path marked out. As said before, few of our Tennessee farmers raise roots of any kind, but if once the habit of feeding with roots was established they would never fail in it afterwards. The large amount of water in roots prepares the food in the best possible manner for digestion, especially when a little meal is

sprinkled over it. Of all roots, however, the Sugar beet is preferable, as will be seen by the table, which is universally sanctioned by experience. It is just as easily raised as the turnip, and is much easier kept. Sheep are very fond of it too, and will greedily devour every particle of it. The crop properly cultivated will yield from 600 to 1,000 bushels per acre."

We do not agree with Colonel Killebrew that Sugar Beets are as easily raised as Turnips—they do not stand heat and drought as well, and are, we think, more difficult to get a stand with. Root crops generally do not pay in our climate. Artichokes are more productive than any other roots, and analysis proves that they are nearly equal in value to Irish Potatoes, much more so than any kind of Turnips, and more so than Mangold Wurtzel and Sugar Beets. This is true if the analysis from Johnson's "How Crops Grow" is correct. We do not know any one who has tried them with sheep. They are well eaten by hogs and cattle, and can be fed raw, which it is not proper to do with Irish Potatoes, and will keep well in the ground all the winter, and may be fed at any time the ground is not frozen. I have raised at the rate of 1,800 bushels to the acre, and think it possible to raise 3,000 bushels to the acre in rich light land.* We have scarcely a doubt they will prove valuable feed for sheep; and we would rather trust to "Ensilage" than to roots, though it might be well to raise some of the latter, as animals like a variety of food, and there is no doubt it contributes to their health. In connection with Fodder-Corn for Ensilage, we suggest that Peas should be raised for the same purpose. The Pea vines might be put up with its fodder-corn, or in separate pits, and fed together, as Peas would furnish the albuminoids in which the fodder is deficient, making the feed a more perfect one, saving grain or meal and bran, which are necessary to use with the fodder alone. Entire quiet is necessary in fattening sheep, and they should be made so gentle that every sheep should be taught to take salt and food from the manager's hand. Dogs should be kept from about them, or they become frightened and refuse to eat; unless indeed one or more dogs are raised and penned with them, which is a good plan to prevent the fear of dogs, and keep off strange dogs.

We may add that mutton eating is on the increase, as proven by the rapid extension of sales in all the large markets, and the price of mutton has advanced more rapidly in this country and in England than beef. This increase in the use of mutton has been brought about by the increase of population, the increase of price of beef, the inferiority of pork and bacon and its unhealthfulness and sometimes its diseased condition, and a better appreciation of the great healthfulness and excellence of mutton. At the same time, mutton from a lean, thin sheep, Merino or scrub, may be the poorest of meats; such sheep having outlived their usefulness, and being consigned to the butcher to get rid of them, afford an unpalatable and unsavory dish, which has taught many to abominate the name of mutton, and loathe its very odor. On the other side of the picture, we see the fatted and tender Southdown, unsurpassed by the aromatic flavor of the venison, the richness of wild game, or the sweet juices of the Short-Horn sirloin.

Lamb raising is a profitable branch of Sheep Husbandry in Virginia, particularly in Middle and Tidewater Virginia, from whence they can be shipped rapidly and cheaply to northern markets. Lambs dropped in January are ready for market in April, and a correspondent (Colonel Washington, of Caroline) wrote me

* One of my colored laborers, from one hill of the common artichoke, raised one peck—putting them $3\frac{1}{2}$ by 16 inches would be more than 3,000 bushels to the acre at this rate.

some time since that for April lambs he obtained \$5 to \$6.50 net, and for May lambs \$4 to \$5 net. He permits his bucks to run with his ewes after August 1st that the lambs may come in January following. Of course, in colder portions of the State it will not answer to have the lambs dropped so early, as the increased care of them, additional feed for the ewe, and the danger of loss of the lambs by the cold, will prevent them paying for the expense and trouble. For this reason the two first portions of the State are particularly fitted for rearing early lambs. To show the difference Randall says lambs are usually dropped in the North from the 1st to 15th of May. For this branch of Sheep Husbandry the larger breeds of sheep are to be preferred, and the grades from them, both because of hardihood and the early attainment of size of the lambs. Attention must be paid to the selection of the ewe for early lambs, which requires judgment and care. They should be good nurses, of vigorous constitutions, be widehipped, broad, shortlegged, early maturing, the best that can be selected from the common flocks of the country. The ram in Middle and Tidewater Virginia should commence running with the ewes in August and September; then the lambs will come in January, February and March; the earlier the better if the farmer is provided with good shelters and plenty of provender. Rye, if sowed in August, will afford good grazing for ewes and lambs in the mild weather of January and February and March. And *Ensilage* will come in at a very opportune time for early lambs; and we think those designing to raise early lambs should provide themselves with this desirable feed. Breeding ewes should not be too fat, and certainly should not be lean, and had better be the former than the latter—the “golden mean” is nearer the former than the latter. Some prefer giving good hay until near lambing time, and then giving some grain, while others prefer to give hay and grain all the time. Some affirm that particular kinds of food make the ewes more prolific. A writer in the Journal of the American Agricultural Association (Vol. 1, No. 1, p. 180), Mr. Arthur R. Jenner Fust, of Canada, says: “My favorite sheep food requires no hoeing. . . . I suppose all my readers have seen *Rape*, or *Cale seed*, the Calza of France. They are pretty much the same thing, and either of them will make sheep ripe fat without any other food. Cows love rape, and give plenty of rich milk on it; but care must be taken that it is not given to them when wet with dew or rain. Insects never trouble it, and as it is sown broadcast it requires no hoeing, and no weed can struggle successfully against it. It is grateful for manure, but on good land of a moderately heavy character it can do without it. A few, say ten, bushels of bone meal mixed with as many of ashes will, on light soils, produce a crop so luxuriant in its lush abundance that the eye is enraptured at the sight. If it is wished that the ewes should *twin* in spring, a fortnight on rape before they are put to the ram will have the desired effect. In 1853 my Hampshire Down ewes, 250 in number, gave birth to 397 lambs. Of fifteen that lambed one night came twenty-nine lambs.* They had lived upon rape from the 25th of August to the 15th of September. The plant grows so high, and is so sturdy and thick on the ground, that sheep do not trample it down as they do grass and clover, for which reason they may be turned loose into a field of it, though the most economical plan is to divide off a piece every two days or so.”

This is pretty much the same plant as our Spring Kale. In another place we shall have something to say of the general managements of lambs.

* In Kentucky 97 lambs are produced from 100 ewes; in Florida 89. Mr. Crutchfield got 190 to 130 lambs to the 100 ewes. With care, one lamb to each ewe may be depended on.—*Sheep Husbandry in the South*.

PROFITS OF SHEEP HUSBANDRY.

As in every other business, this is an important point to consider, and one easier to speak definitely on than on the profits to be derived from many of the undertakings of mankind. Who can predict with any certainty the profitable results to be obtained by the professional man, by the merchant (ninety-seven out of one hundred of whom are said to fail), by the miner, by railroad men, &c.? Where sheep husbandry has been properly attended to it has not failed to pay. As one evidence of the profitableness of this industry, it has been observed that wherever it has gotten a foothold in a country there it has remained. In the time of the Romans, when they conquered Spain, fine breeds of sheep were found all over the country, and for centuries Spain maintained a prominent reputation as a sheep growing country, and, in spite of its decline in political power among the nations of the world, it still maintains much of its former fame as a sheep growing country. From here Spanish sheep were carried to England, and, mixed with the native breeds which were there in very small numbers, gave rise to the many excellent breeds and crosses found in that country. From a few thousand they have now increased in England, Ireland and Scotland to over 60,000,000. In Australia the number is 60,000,000; in Russia, 50,000,000; in the German Empire, 29,000,000; in Austria-Hungary, 21,000,000; in France, 26,000,000; in Asia, 175,000,000; in the United States, by estimates made in 1876, there were 36,000,000.

These statistics prove that where sheep husbandry is established in a country it makes no "backward steps," but rapidly progresses, which it would not do if it was not profitable. It is a more certain industry than crop raising, though of course the two should go "hand in hand." One of the profits of sheep raising is the improvement of lands by this stock and increase of crops. We say that sheep raising is more certain than crop raising. This will be apparent when we think of the bad seasons destroying crops, insects greatly reducing their yield, and the uncertainties of the cultivation of poor lands. Occasionally flocks are much injured by disease, but this does not frequently occur, and probably scarcely ever would, with proper care. The day has gone by when sheep can be only profitably raised for wool. The numerous and rapid transportation lines put it in the power of many of our farmers to make lambs and mutton profitable, a great advantage over former times. We can now, in most parts of the State, raise sheep profitably for mutton, wool and lambs, and for certain improvement of the lands they cause, which last is a very important item. Markets for mutton are extending, as shown by the shipments of mutton to England, where the prices have advanced more rapidly than that of beef, showing that the English are a race of "mutton eaters," as well as of "beef eaters," and indeed the English, it is said, eat more mutton than beef. In the United States it is not a favorite meat with the majority, though its popularity is increasing.

The raising of lambs, where the markets are accessible, and when they can be gotten to market early, is very profitable, and this particularly for Middle and Tidewater, but is not confined to these regions of the State. In "Sheep Husbandry for the United States," a report is given from Mr. John Carmichael, of Loudoun county, in which he says, "the value of spring lambs sent to Washington varied from \$2.50 to \$5, according to quality; that Western ewes bought in the autumn for breeding cost \$2.75, their lambs average \$2.30, and their wool \$1 more. The ewes are fattened and sold in the fall for \$4 to \$5. This makes the

gross returns of the year about \$8, or \$5.20 above the cost of the ewe for feed and profits." Some testimony regarding Middle and Tidewater is given from the same authority. Mr. Thomas F. Rives reports from Dinwiddie county, saying: "Captain Shelton has a fine flock of grade Southdowns. He sows rye and winter oats, thus supplying good winter pasture. His lambs are dropped in the early part of January and some in December. He generally has a lot of fat lambs in market by the middle of April, and always commands a good price for them—from \$5 to \$6 per head." This shows as well as Colonel Washington's experience, before quoted (for Caroline), the high price *early* lambs bring in the market, and the advantages of these sections in this respect.

Mr. William F. Jackson, Amelia, Va., says: "The large land owner will tell you it pays 100 per cent., and beats farming to death"; but says, "I have no fences; it would bankrupt me to fence my lands, and if I did in ten days the dogs would kill all my sheep. I cannot go into the speculation; it might ruin me at once." There is some force in this, but it seems to me the venture might be more profitable and less hazardous by employing a herdsman, without fences, except for enclosing them at night. We think "the large land owner" takes a rather exaggerated view of fences and dogs. The publication referred to says: "Examples of small flocks which have been a success are numerous. In Northumberland county, according to a former return of a correspondent, a flock of sixty-eight ewes, costing \$3 each, produced one hundred lambs the first year, which brought \$5 each in May, netting nearly \$300 above the original cost, with the original flock and wool on hand. They were turned into a wheat stubble seeded with clover, and had no other food and little attention. Mr. William P. Austin, of Lunenburg, Va., reports a flock of forty-eight kept at a cost of \$10 per annum for shearing and feed, exclusive of pasturage and care, yielding an average of \$93 per annum. Mr. W. B. Chalkley, Chesterfield, Va., has a flock of forty sheep worth \$100, and has sold twenty-four for \$60 and 150 pounds of wool for \$34.50. The cost of the original eighteen was \$42, and the cost of keeping two years is estimated at \$30. The gain is equivalent to \$122.50."

A correspondent from Clarke county, Va., says: "It is far more profitable to keep the different varieties of mutton breeds than the fine wool or Merino breed in this portion of Virginia. I say this from my own experience and that of many intelligent gentlemen with whom I have conversed. The Cotswold sheep and its crosses with the Southdown are less liable to lose their lambs than the Merino. The lambs are more vigorous and hardy; then add their early maturity, fitness for market at eighteen months old, and their almost double value when in market, and you have advantages which far outweigh the additional amount of food which the mutton sheep may consume in proportion to his size. I have said nothing about the difference in the value of the wool, because I believe there is very little difference; if there is any it is in favor of the mutton breed of this county." Mr. Mark S. Cockrill, Davidson county, Tennessee, which is nearly the same latitude as Richmond, says: "I have lived on a farm all my life (forty years), and assert from close practical observation and experience that one hundred per cent. per annum can be made on money actually invested in sheep in Middle and East Tennessee. But it requires a knowledge of the natural enemies of the sheep in this latitude, and how to prevent or avoid them." What is true of this locality is, we suppose, true of most of Virginia, though we are afraid the estimate of profit is too large unless for small flocks, and when they have no casualties or serious disease.

If the sheep raisers of New York can find raising wool profitable where, according to Randall, the cost of producing a pound of wool is 27 29-95 cents per pound, what must be the profit on it in the Southern States where, by the same authority, it costs only 8 1-12 cents (allowing 3 pounds to the fleece in each case)-Mr. John S. Skinner. in a letter written to Dr. Randall, says: "Hon. Mr. Coles, member of Congress from Virginia, a sedate, attentive and practical farmer, once informed me that his flock of 200 sheep, kept in good condition summer and winter, did not cost him \$10 per year. . . . You must know that they, in the general way, as I believe, never feed their sheep, winter or summer, except where the ground is covered with snow, which is rarely the case, and then snow does not lay long, not more than a day or two. . . . No doubt winter pasture might be provided by sowing rye in the proper season (the usual system is to sow it about the last thing, and as long as the farmer can 'catch a chance'), and putting the ground in good condition; and in that way adequate provision might be made for any deficiency of natural pasture. . . . Where snow does cover the ground in Virginia, they give the sheep corn-blades and excellent fodder. I think the rule was, when I was a boy, in the rare exigency alluded to, to give them a bundle of the blades each, which *compacted* would be about as large as the upper part of your arm." It is stated that Mr. Coles thought the expense of growing wool in Southern Central Virginia was less than 3½ cents per pound, while Mr. Skinner repeatedly expressed the opinion that wool could be grown in various parts of the Southern States at 3 cents per pound. Dr. Randall says his own impression is, however, that the land properly enclosed that will support 3 sheep per annum will cost, except in occasional localities, not less than \$4 or \$5, let the amount be more or less; and this would bring the cost of production (with 3 pound fleeces) to between 7 and 8 cents per pound, and that he will hereafter assume it to be 8 cents.

In 1878, I sent out a circular to get information from sheep breeders concerning the best breeds, and crosses, sizes of flocks, sales of mutton, wools and lambs, profits, &c. Some thirty-odd replies were received, and almost without exception the opinion was expressed that sheep raising was profitable; they generally however advise that flocks should not be large, or the profits will be diminished. Mr. R. B. Haxall, of Orange, says: "I believe sheep yield a large per cent. of profit, but the investment is small chiefly because of the dangers they are exposed to and the difficulty of keeping them in good health, if the flocks should be much enlarged."

Nevertheless we know that the mortality in sheep is small, particularly if they are managed with any care—much less than in hogs and in cattle, thousands of which are annually swept off by cholera and pleuro-pneumonia.

The Smyth County Agricultural Club, Dr. Apperson, Secretary, says: "Where sheep have had good attention, they pay handsomely." Mr. C. M. Reynolds, now State Treasurer, says he has a flock of 150, and finds the profits on the investment good, particularly for the wool, but says: "A small flock of good sheep will pay a handsome percentage on the capital; but unless you have enough to justify a shepherd, and shepherd dogs, with constant attention, a large flock will not pay. I cannot keep 100 in healthy condition without a wide range of pasturage."

But think of the large flocks of sheep successfully managed in other parts of the world. Mr. F. W. Schaeffer, of Texas, owns a flock of fifteen thousand, and is one of the most successful wool growers in the country. Mr. Bergimer Flint, of California, told me (during the session of the International Exhibition of Sheep

and Wool in Philadelphia last fall) of a large island off the coast of Mexico owned by himself and others, on which they were keeping a flock of from fifty to sixty thousand of Merinos. Perhaps there was more than one island. These facts show that large flocks can be kept successfully.

Col. John Washington, of Caroline, from 50 to 60 ewes, receives a return of \$300 to \$450, besides furnishing his family with mutton and lamb.

Col. Killebrew, in speaking of the profits of sheep raising, says: "A statement of Mr. Jurian Winne, of Albany county, N. Y., in regard to fattening sheep (in the Agricultural Department of the Patent Office for 1869) will give some idea to our Southern farmers of how the thing is done better than a long description. He has followed it for years, and amassed a large fortune by it. In this year he made but a small profit, from the fact that instead of buying himself he sent out agents, and they paid extravagant prices, and, as already stated, the great profit lies in the purchase of the stock. The extremely heavy snows in the spring kept him feeding longer than necessary, involving a considerable loss also. Still, the final result is very satisfactory, when we consider the small capital invested.

Here is an abstract of his proceedings :

...—Cost of 445 sheep.....	\$3,250 00
Feb. 14, 1870.—He bought 180 fine wool sheep at \$7.56 per 100 pounds—	
weight, 18,580.....	1,424 00
Total cost at start.....	\$4,674 65

Expenditures.

1,245 bushels corn at \$1.....	\$1,245 00
8 tons mill feed.....	204 00
300 bushels oats.....	150 00
134 bushels peas and oats.....	71 32
60 bushels barley.....	42 00
Oil meal.....	76 12
40 tons hay.....	320 00
Salt.....	20 00
Attendance one man.....	120 00
Expense of selling.....	61 12

Total.....	\$2,309 56
Adding cost.....	4,674 65
Total for the fatted sheep.....	\$6,984 21

Sale Account.

April 7, 1870.—247 coarse wool sheep, weight 37,860 pounds, at 9½ cents	
net.....	\$3,502 05
April 14, 1870.—184 coarse wool sheep, weight 28,320 pounds, at 9½ cents	
net.....	2,690 40
180 fine wool sheep, weight 19,730 pounds, at 9½ cents	
net.....	1,800 36
2 sheep with lambs.....	20 00
8 sheep butchered and sold.....	85 00
4 sheep died—lost.	
Total sales.....	8,097 81
Net profit beside manure.....	\$1,113 60

"The manure forms no inconsiderable item in the above calculation. The owner derived (though this was not a fair test) \$1.80 on the whole lot per head, but on the fine wool sheep it was about \$2.47 per head, and they were only fed two months. In this case there was no stint of feed; on the contrary, they received double as much as would be necessary in our climate." It is true a big price was received for them from proximity to a large market, but the sheep here and in Virginia could have been bought for half the amount, and the provender in the latter locality would not cost more than one-third as much as in the former. The profit, considering the duration of the investment, was very good, and it can be made in the South at the same or better ratio. Colonel Killebrew says it is the custom of many feeders to buy and sell continuously. They keep a large feeding lot, and keep a buyer out all the time, and every few days the flock is culled of all suitably fat. In this way there is no remission of buying or selling. . . .

"There is yet another class of sheep raisers, who follow an entirely different system for profit, and inasmuch as they persist in it, we may suppose they find it profitable. They will make a selection of as many ewes as their farms can accommodate, in August. To every 35 or 40 ewes they will add a good Southdown or Cotswold buck, and put the ewes to them, say by the 15th of August. These ewes are kept in fine condition through the winter, and in the latter part of April they are sheared. The wool is sold as one part of the profit, and the lambs are sold off in the latter part of May, when the ewes are rapidly fattened and sold to the butchers. By the end of June the farmer has disposed of his entire flock, when he will clean up his lots, spread his manure, and in a month is ready to tread again around the circle. By actual demonstration, the following account will exhibit the profits of this method of farming:

One hundred ewes at \$2.....	\$200 00
Four rams at \$10.....	40 00
	\$240 00
Average price of 80 lambs.....	\$240 00
Four hundred pounds wool at 30 cents.....	120 00
Four rams at \$10.....	40 00
One hundred fat sheep at \$5.....	500 00
	\$900 00

"The manure will well repay the attention given them, and the only money expense attending this transaction is the food necessary to be used during the hard weather of the winter. Those who follow this plan usually are well supplied with blue grass pastures and the food raised on the place; so that, in selling the sheep, they really are only selling their crops at a full price, as well as utilizing the grass that would otherwise be lost. It may be objected that no deduction is made for incidental loss of sheep; but every flock-master will testify that the surplus of lambs over 80 per cent. will fully compensate for all losses, unless the farmer is criminally negligent and suffers, for want of proper protection, his flocks to be destroyed by dogs and starvation. Here is a gross profit, on an investment of \$240, of \$660, and estimating the feed, over and above the grass, to be \$1.50 a head, there is a net profit of \$350. Remember, too, that the \$300 go into his own pocket for farm produce, and we cannot think of anything a farmer can raise on his farm that will surpass this small investment. By taking care in the purchase, he can often get the ewes for a less sum than here stated, and I am sure the prices

received are of the most reasonable character. The earliest lambs, indeed, rarely sell below four dollars each, while the latest ones, provided they are good and fat, will bring the estimated price, \$3. So this must be taken as a fair average experiment.

"Another gentleman bought 25 ewes in August, for which he paid \$75. In the following May he sold the lambs, number not stated, for \$101. In May he sold a portion of the ewes for \$98.70, and in June the balance for \$72. He got \$60 for the wool. Allowing the food to cost fifty cents per head—and it did not exceed this, as grass was almost wholly used—and a net profit of \$244.20 was realized.

"Summing up the whole subject, it may safely be asserted that in its various branches, whether as wool, mutton, or lamb sales, there is no branch of agriculture that offers greater inducements to the farmer than sheep raising. The sum necessary to get a start is by all odds less than in any other branch of stock raising, and its returns are quicker."

Another important item of profit in sheep raising, and one too little appreciated, is the improvement of the lands by this stock. No animal cleanses the land like the sheep, from briars, and bushes, and coarse grasses, and shrubs, which it is generally impossible to eradicate without the plow. Even the trampling by the hoof of the animal has an ameliorating effect, and this has given rise to the proverb that "the hoof of the sheep is golden." While the hoof does good in compacting loose, spongy soils, particularly when in wheat or rye, pressing the roots in the ground when loosened by freezes, no doubt the droppings do most of the good. Much good is done, no doubt, by their destroying worthless growth on the land, by their browsing on the buds and stripping the bark from the shrubs, thus cleaning up fence corners and other places the plow cannot reach. Some one has said that it would be good economy for the farmer to keep his neighbor's sheep without charge on all very briery and foul, unarable lands, if he could not so stock them himself. Sheep not only clean up such lands, but they seem to exert almost a *specific* influence in improving the character of the vegetation. The wild, poor grasses gradually disappear from the fields, and are succeeded by the good ones, the sward becoming remarkably dense and even, probably the latter being due to the richness and better distribution of their droppings and urine. The winter manure of the sheep is superior to that of any other animal, the hog excepted, and it becomes still more so in proportion in summer when scattered over pastures evenly, and without the expense of hauling and spreading. The soft, porous excrements of the horse or cow, exposed to the drying of the sun and air, give off much of their valuable properties into the air, and this effect increases with the warmth of the climate. But the excrements of the sheep are deposited in small, hard rounded balls, which find their way under the grass and leaves, and thus are much protected from the sun and wind, until they are gradually decomposed by the rains and freezes, or are trodden and broken up, until they find their way into the soil. And the sheep, by instinct and desire, seek the higher and drier elevations for night quarters, and thus leave their deposits on the more barren portions of the field, just where they are most needed, and where, being removed from water courses, less of the juices are washed by rains into the streams and lost. By the use of sheep, by their consumption of much useless matter, shrubs, coarse grasses and briars, by their cleaning up foul land, by their trappings, and droppings, and consequent formation of sod, and then by liming and the use of green fallows, there is very little land in Virginia that cannot be greatly improved. We

have all heard of the important part sheep husbandry plays in the improvement of the lands of England, and an Englishman scarcely thinks he can farm without sheep.

The following testimony was taken before the Committee of the House of Lords charged with the inquiry into the state of the wool trade, &c., in Great Britain in 1826. It is the testimony of some of the most eminent and respectable farmers of that country :

"Mr. William Pinkney, Salisbury Plain : Land such as I occupy could not be maintained without the aid of sheep. . . . The sheep are our principal dependence for supporting our crops ; indeed, I could not occupy my farm without my flock.

"Mr. John Ellman, Jr., Sussex : I do not consider it possible for the light lands upon the Downs to be kept in cultivation without flocks. I could not keep the farm I now hold without sheep. . . . On the Southdowns the wool must be grown, let the price be what it will.

"Mr. Francis Hale, Altringham, Suffolk : The description of land I occupy could not be kept in cultivation without the aid of sheep.

"Mr. Henry King, Chilmark, Wiltshire : The size of my farm is about 4,000 acres. I clip annually about 6,500 Southdown sheep. . . . Such lands as I occupy cannot be kept in cultivation without the aid of sheep.

"Mr. John Woolledge, near Bury St. Edmunds, Suffolk : An estate near the above place contains 8,890 acres, let to tenants, and consists principally of poor sandy and gravelly land, the produce of which in grain is very precarious, amounting in dry summers to little or nothing. The occupiers, therefore, depend almost entirely upon their flocks of sheep for the payment of their rents and the employment and support of the population. . . . I am of opinion that two-thirds of the counties of Suffolk and Norfolk may be comprehended in the sheep districts, and that they produce two pounds and a half of wool and three-fourths of a lamb to the acre, upon an average. . . . The produce of the land depends materially upon the folding system ; there is not sufficient straw for manure without the assistance of sheep.

"Mr. William Ilott, Abbey Milton, Dorsetshire : I calculate the annual growth of wool in Dorsetshire at 10,000 packs of 246 pounds each. It is estimated . . . that 800,000 sheep, or one sheep and one-seventh per acre . . . are kept in this county. A considerable part of the county of Dorset is composed of light lands, and can only be kept in tillage by the aid of sheep.

"C. C. Western, Esq. : It is utterly impossible that the Down districts can be cultivated to advantage without sheep. We never fold our Merino or other sheep; the land is too wet.

"Lord Napier : If we had not sheep upon our lands (the highlands of Scotland), it would become the habitation of foxes and snipes, and return to waste ; it would produce nothing but grouse and wild game of different sorts."

It is not hard to see why sheep are better than horned cattle in the improvement of lands. The short and scant pasturage on which sheep will thrive will not do for cattle ; on such lands large flocks cannot be profitably carried, or even small ones, unless the area is large. The English farmers are convinced that sheep give a better return for food consumed, and better repay in the expenditure necessary to bring poor land into a profitable condition for cultivation. In an able

essay in the *Plough* (June, 1846,) the following remarks occur, which may be regarded as an expression of the prevailing opinion in England: "It is justly admitted that of all the domestic animals reared and fed for profit in Great Britain, sheep are of the greatest consequence both individually and in a national point of view, and afford a better return than can be obtained either from the rearing or feeding of cattle; the very fierce annually shorn from their backs is worthy of consideration. Sheep husbandry deserves to be considered in all its different branches, and claims the priority of consideration among agriculturists." The expression here the "very fleece" shows that the English people rely upon the sale of mutton and the enriching of their lands for grain by means of sheep. By feeding from the land by aid of hurdles large crops of turnips, for the growth of which the climate of England is peculiarly suited (which is not the case with ours), the ground is well prepared for heavy crops of grain. Both in England and in this country it is found that poor and light soils are particularly suitable for sheep, because such lands will not carry cows successfully, while they will sheep, to their great improvement, particularly with the use of lime and green fallows. Thousands of acres in Virginia, now lying idle, and which are accessible to lime, might be made profitable for cultivation by rearing sheep on them, liming, and fallowing in peas and rye, to be followed with clover. We urge this system on the Tidewater section with its extensive deposits of marl (green sand and carbonate lime). And many an abandoned old field grown up in pines, might be cut down, suffered to lie twelve months, mared, sowed in peas or rye, these to be turned under, and followed with clover. The hoof of the sheep could be used in trampling down the peas before fallowing, while the sheep would be fattening for mutton, and in the winter and spring the rye could be grazed by the sheep, being taken off time enough for the rye to grow up for a fallow. If peas are sown early enough, they may be turned under, and a crop of rye seeded, on which the sheep, as before stated, could graze in the winter and spring. This system, too, could be adapted to other portions of the State, for every section has poor lands, and there are few localities where lime may not be obtained at reasonable prices. Near the cities, we advise the use of gas lime which sells now for about 2 cents per bushel, and which, by exposure to the air for a short time, loses some caustic property it possesses, and becomes as useful as any other form of lime—some think more so. If the land is too poor to bring peas, then a mixture of phosphoric and potash must be used, say 200 pounds South Carolina phosphate, or fine ground bone, or superphosphate, and 100 pounds muriate potash (80 per cent). But 200 pounds fine ground South Carolina phosphate and 300 pounds Kainit (German) potash salts to the acre, is as good a preparation to use as any other, if the farmer will get the Kainit analyzed, which should contain 23 to 25 per cent. potash (generally in the form of sulphate). This preparation will cost about \$4 per acre, exclusive of freight. Dr. St. Julian Ravenel, of South Carolina, a chemist and a practical farmer, says that this preparation, which he calls "Ash Element," produces on the light coast lands of Carolina such crops of peas that he finds them difficult to turn under. I suspect we usually sow too small a quantity of peas. Mr. Ruffin, we think, recommended less than a bushel per acre, and one bushel is usually seeded in Virginia, while in the Northern States they sow 3 bushels at least.

On the wornout granite soils of Middle Virginia, which usually have a red clay subsoil, *deeper plowing*, in order to carry out the improvement suggested, is necessary. These soils are, many of them, only worn out on the surface. As an evidence of the propriety and profit of bringing red clay soil to the surface, I have

more than once adverted to the effect produced by throwing down the batteries around Richmond, which are almost entirely red clay. For several years I have noticed the greatly increased growth of corn and wheat and clover on these thrown down batteries, which are nothing but a mass of red clay: and this year, in the wheat field of the Messrs. Haxall, adjoining my farm, I have noticed the growth of wheat on a battery thrown down last fall; the wheat had a greatly increased growth, so much so as in some places to tumble. Over a ditch 10 or 15 feet deep, carrying the supply pipes to the new Reservoir, I sowed oats some years since, after the ditch had been filled in with the red clay, which had been exposed to the freezes during the winter. The growth of oats was nearly double what it was on either side, and during the fall a "Lamb's-quarter" weed came up in this soil, which reached the top of my head as I sat on horseback. These facts show not only the goodness of this red soil, and the propriety of turning it up, but they also show the great advantage of *friability* and depth of soil. In these localities there was nothing to prevent the roots from sending themselves as far in search of food as they pleased.

Dr. Randall advises peas to be soaked in a solution of nitre, rolled in lime, top-dressed after sprouting, with a slight sprinkling of ashes and gypsum. Analysis shows that the seed of pea requires a large amount of potash and the straw of lime. Plaster will act on peas if it will on anything, but in most of Eastern Virginia its action on vegetation is very uncertain, and on many of these lands it has no action.

Another profit of sheep husbandry, rather indirect than direct, is the opportunity it affords for diversification of farming products. No country or farmer should rely on one crop as a moneyed crop. If that crop fails, the revenue for that year is gone. Crops, too, should be sufficiently diversified for the planter to raise everything as far as possible to supply the demands of the farm and family. Mixed husbandry is important in preserving the existing fertility in soils capable of cultivation, and not only in maintaining this fertility, but in increasing it. To this end, rotation of crops is almost indispensable. For many years, wheat was raised in frequent succession on the best wheat lands of New York. These lands rapidly declined in production, but are said to have recuperated under rotation and the application of phosphoric acid, which had for many years been abstracted by cultivation, without being returned; at the same time, the *grazing* lands of Southern New York have been constantly improving, and approximately in value the lands of the famous wheat region of the Genesee valley. The same system has prevailed in the rice and cotton lands of the more Southern States and the tobacco lands of Virginia. The consequence has been the neglect of the great body of the lands and the concentration of manures and fertilizers on a small area devoted to these particular crops. Another view of the matter is that there may be over-production of cotton, as there is now of tobacco, as far as Virginia is concerned. It is calculated that the four States bordering on the Gulf of Mexico, viz., Louisiana, Mississippi, Alabama, and Florida, containing 130,000,000 acres of land, would, if only one acre in 32 produced 250 pounds of cotton, furnish cotton enough for the supply of the world—leaving Georgia, South Carolina, North Carolina, Virginia and Texas out of the calculation. (Report of the Committee of Agriculture of House of Representatives of South Carolina, Dec. 14, 1842.) But since the report Texas has "loomed up," and in 1875 less than one-half of 1 per cent. of its area produced one-half of the cotton consumed in the United States—and 4 per cent. of its area would be capable of producing all the cotton now con-

sumed in Europe and the United States, over 6,000,000 bales. (Report of Edward Atkinson on Cotton at the International Exhibition.) So Virginia and the other States, exclusive of the Gulf States, had better look to some interest more permanent than cotton. They cannot raise cotton as profitably as these more Southern States, and with this great territory, including Texas with her 270,000 square miles, we may at any time fear over-production of this staple, particularly as India and other Eastern States are extending its cultivation. We shall presently show that there is little fear of over-production of wool and mutton. The raising of sheep, the grazing of lands, formation of sod, the turning in of green crops, the production of clover, and the increased facilities thus furnished of making hay and raising grain, will enable us to diversify our productions, and not depend alone upon tobacco, wheat and cotton for money crops. By all means, stock raising, including sheep, should be for Virginia important sources of income—for with this, independent of the profits, follow great improvements in land, in increased production of crops, besides the minor inducement of fresh meat for the table.

The impropriety and bad policy of devoting all the labor and best land to the exclusive cultivation of one or two crops has become manifest to many of the best farmers. Besides the deterioration of their lands, which surely follows, they find themselves buying in years of scarcity at high prices things they should have raised—corn, bacon, fresh meats, butter, vegetables, &c., and sometimes horses for farm work. The deterioration of lands has been the history of tobacco raising in Virginia, and we are told also of cotton in the South. It has frequently been the policy there to wear out a farm in cotton, and remove to Arkansas, Texas, or some more virgin State. Rotation is all-important in the improvement of lands, and some portion of the crops of every rotation must be returned to the land in the form of manure, either green or animal manure. If the first, the crop is plowed under, and if the latter, the crop is partly converted into manure by animals pastured on it; and this turned under with the remaining vegetation. The crop is worth almost as much for manure, after passing through the digestive apparatus of animals, as it would be turned under green, and then we have the profit made by the animal in meat, wool, &c., with little cost. Sheep being the best improvers, and the most profitable animals, will best sustain a profitable rotation, enough other animals being raised to supply the home demand. In rotation of crops, we endeavor to succeed one plant with another which requires those inorganic substances which its predecessor did not, or at least in small proportions, and vice versa. The natural recuperative process will repair the waste made by each plant before it again occupies the soil, in a judicious rotation if we aid the process by means just adverted to. Observant farmers have learned to put in practical operation many judicious rotations. Among the most striking of these is to follow tobacco, not corn, with wheat, and this is because tobacco and wheat need less of similar inorganic elements than wheat and corn.

IS THERE A PROBABILITY OF SHEEP RAISING BEING “OVER-DONE”?—FUTURE DEMAND AND SUPPLY.

Some have feared that should the United States carry out this industry to the extent of the capacity of the country, that the supply of wool and mutton would exceed the demand. That if the United States were to increase sheep in proportion to the number raised in England that there would be a surplus production in

the markets of the world. It would take a long time for this increase of our sheep to take place. The use of mutton is annually increasing in this country and in Europe, and by the use of refrigeration the quantity shipped from this country to England is already very considerable, and increasing. If "hog cholera," or, as the veterinarians now call it, "swine plague," and "pleuro-pneumonia," among cattle, together with the fear of trichinosis, are not abated, the use of mutton as diet must largely increase. Sheep in this country are subject to no disease that carries them off in large quantities—if sick, most are apt to die, and that speedily, so that persons have little fear of contaminated mutton, while they know that large quantities of hogs and cattle are slaughtered and thrown on the market where swine and cattle diseases are prevailing, the animals being taken from the midst of contaminated flocks, themselves no doubt being often contaminated.

If the Southern States were to go extensively into wool raising, the present product of wool would be greatly increased, perhaps forty or fifty millions of pounds, and if there is an adequate supply of wool now, there might be a large surplus, but we are not ready to admit there is an adequate supply of wool for the world. It might be cheapened and still be profitable. There are many inhabitants of the world who go insufficiently clad in woollen clothes to face the severe weather of winter. While we do not advocate the cheapening of wool, it would be a blessing to many of the shivering denizens of the colder climates. The South can produce wool much cheaper than the Northern States, and if reduction in price was caused by increased production, the North would stand no chance in competition with the more favored South. North of 40° there is little disparity in the cost of the production of wool, except as land varies in price, particularly near the cities, and on the slopes of the Pacific, where the line of equal temperature is 5° north of that east of the Missouri river. For some time it was thought that the cheap *prairie* lands of the West afforded great advantages over the lands of the East—and that probably they could produce wool cheaper than the Southern States. If this were so, so great is the extent of these natural pastures west of the Mississippi they could furnish the entire demand for wool of the United States for many years to come, and it would be useless for the South to attempt the competition. Not many years since large numbers of Northern and Eastern sheep breeders purchased up prairie lands, drove large flocks hundreds of miles to occupy them, fitted up well arranged establishments, with the expectation of realizing large profits. These expectations were doomed to disappointment, and the experiment is generally considered a failure. The grasses on these prairies dry up, and lose their nutritive value by midsummer; and another rather unexpected result occurs with these grasses, which is almost fatal to the profitable feeding of sheep on these lands. They soon become extirpated if kept fed down, some even in a single season, and the only resort is to feed on fresh grasses the next season, so that a small flock will run over a large area or become poor and depredate. After the 1st of September, generally, the prairies afford no adequate pastures, and the general testimony confirms the above statement, and further that these grasses, though vigorous while they last, are short lived. It might be supposed that the extent of these prairies would obviate some of these difficulties by giving land enough for constant removal of flocks, but there are many persons in the same business and the competition is strong. The consequence of this giving out of these natural grasses so soon, is that sheep must be fed about six months in the year unless good artificial pasturage is provided. The cultivated prairies afford good pasturage, but

it must be a long time before much land can be thus provided, and even then the severity of the winters will require foddering for a long period, compared with our climate. The prairie grasses fed over by sheep, and dried by midsummer droughts, make poor dry hay for winter, almost worthless. The cultivation of prairies is very difficult and costly. It requires from 4 to 6 yoke of oxen to break up one to one and a half acres per day of these lands.* Then building is very expensive on account of scarcity of timber, and fences almost impracticable except on the edge of the prairies. Then the scarcity of fuel is another great tax on agricultural interests, and the scarcity of water is another great drawback to sheep raising, knowing as we do how necessary fresh water is to sheep. Hedges have been attempted, but it is almost impossible to get any hedge plant to stand the severity of the winters, and if this difficulty were removed, hedges would have to be fenced in when young, to protect them from animals which would browse on them and trample them down, and where is the timber to be obtained for this purpose? All these difficulties would, as far as they can be surmounted, make these lands cost as much as the Eastern lands. But the want of fuel, and water, and timber, and fences, and the cold climate, cannot be obviated. It has been supposed that the use of shepherds and their dogs would preclude the necessity for fences, but when wool growers become numerous on the borders of the prairies, as they will do if these regions possess any peculiar advantages for wool growing, flocks cannot be kept separate without the use of the large number of shepherds which are required in Spain, Germany, and Australia, for like services; the cost would be more in the end than fences where wood and stone are plenty. Then, we can imagine how long it would require flocks and shepherds and their dogs to get accustomed to these circumstances. If flocks cannot be kept separate we see the difficulty and trouble of flocks running together, the impossibility of separating the sheep of each owner from the general flock on large prairies, for purposes of selling, washing, shearing, folding, &c.—the difficulty of preventing interbreeding by indifferent rams and ewes, and at improper times, and of preventing theft when no man could tell his flock. And how could the spread of contagious diseases be avoided—scab, hoof ail, &c.—where it would be impossible to separate the sick from the well and to apply proper remedies?

In the face of these facts, we do not think we have much to fear from a competition of the prairie lands of the West in sheep raising, and we find here additional reasons why Virginia should go on perseveringly in this industry until it becomes a great and profitable interest in our State.

One rather remarkable fact in connection with the climate of this region west of the Mississippi we did not mention. This climate of the Western and Northwestern States is more variable, exhibiting more sudden and greater extremes than the climate of Virginia, or of even of New York and New England. To this is probably due the large mortality of sheep on the prairies. Dr. Forry states that the mean annual range of the thermometer at Eastport, Me., in summer, is 104°, while at Fort Snellings (in Iowa), and Howard (Green Bay, Wis.) in about the same latitude, it is respectively 110° and 123°, while the cold of the North and Northwestern States is so much greater than that of the Southern States, few persons are aware that the extremes of heat in the former often exceed very much the temperature of the latter. Fort Snellings, in latitude 44° 53', lying between the Great Lakes and the Missouri, has a maximum summer heat of 93°, the same

* Mr. Solon Robinson in Randall's "Sheep Husbandry."

as that of *Washington City*, in latitude 38.53 , and *Old Point Comfort*, in latitude 37.02 , while at *Fort Moultrie*, *Charleston*, latitude $32^{\circ} 42'$, it is only 90° ; at *St. Augustine, Florida*, latitude $29^{\circ} 50'$, it is 92° ; and at *Key West*, *the most southern possession of the United States*, it is 89° . The minimum winter temperature of *Fort Snellings* is -26° , that of *Washington* is $+9^{\circ}$ (— signifying below zero and + above zero); *Old Point*, $+20^{\circ}$; *Key West*, $+52^{\circ}$. These facts show the great variations in temperature at these points in the West, and the great comparative variations of temperature of points in the West, and those in the East, in the same flocks on latitude. These things in all probability serve to explain the great mortality in the prairies, and which is frequently attributed to over-driving, poisoning, &c. The effect of cold is exhibited in the deaths occurring in our late unusually cold winter. *Green & Farrar*, of *Gordonsville*, in their little publication, "*The Flock Book*," issued in April last, say "we are sorry to quote losses on sheep heavy in this Piedmont section of Virginia; old and young sheep have suffered from a catarrhal fever" (probably pneumonia). The "*Shepherds National Journal*," Spring 1881, says:

"Reports from many parts of the West, and, in fact from all sections of the country, show that the past winter has been a long, cold one, and is continuing (up to the present date, April 4th,) with an unusual amount of snow. In the upper portion of the *Muskingum Valley, Ohio*, the snow is one foot, and near *Columbus* it is two feet deep, and has been falling for a considerable part of the time for the past week, with the mercury ranging from 15° to 28° above. There is heavy snow in many of the Northern and Western States. Feed has been used up closer than usual, and in some sections it cannot be purchased at any reasonable cost. Where feed in sufficient quantity could be had, sheep have wintered well. A large number of growers have fed sparingly, on account of the limited supply and high price of feed.

"The winter has been comparatively more severe in the West and Southwest. The greatest losses have occurred where pastoral sheep husbandry is pursued. Under this system, individual cases have been reported where 25, 50, and 75 per cent. of the flock were lost from the severity of the winter, and lack of feed, upon the ranges. The extent of losses in this system of sheep husbandry has not yet been fully reported, and we are unwilling to attempt, at this time, to give anything definite as to the aggregate loss, or the particular section where it has been greatest. The coming clip in these sections will be reduced in quantity, but to what extent, is not yet known.

"From various causes, some of which are not well understood, the loss of lambs in some sections is greater than for some years past. Reports have been received from a small number of wool-growers from *Athens, Morgan, Muskingum*, and *Licking counties, Ohio*, showing the loss of lambs to be considerable in some flocks. In most cases the lambs showed but little, if any, lack of strength when lambled, but became weak and sick after one or two days, and would die from three to six days old. The strong probability is that the ewes have not had sufficient exercise and green feed during the winter. The abundance of snow has prevented the ewes from procuring any portion of their winter feed from the fields; therefore, they have continued near their sheds or feed-lots.

"The continued cold weather and want of grass has caused a deficiency in the supply of milk."

It is very rare for Virginia to have such a winter as we had in 1880-'81—no such cold having occurred since 1857—a period of twenty-three years—and it is very rare that we hear of sheep dying in our State from the effects of cold. As to the competition of Mexico and South America in wool, the portion of the former suited for wool-growing bears a close resemblance to our Western Territories bordering it; and the *Pampas* of South America resemble very much our Western *prairies*, being covered with wild grasses, and destitute of timber; they are more extensive than our prairies, are subject to furious western winds, called *Pamperos*, which sweep the country, and sometimes forcing whole flocks of sheep into streams, they perish. Wool-growing has been prosecuted on the vast *pampas* of Buenos Ayres, but not to any great extent, or very successfully. The population is an indifferent one, not skillful in agriculture, or industrious, many of them leading wandering, unsettled lives; security to life and property is far less than in the United States. Dr. Randall says, “taking all things into consideration, and looking to the future, I would sooner advise any one, even in an exclusively economical point of view, to purchase the cheap lands of our own Southern States for the objects of sheep husbandry, than any part of South America. With the present duty and cost of transportation against the latter, there is no fear that it can undersell in our markets the produce of the former. The 7-cent South American wools, washed, will cost 14 cents, and washing will add 1 cent a pound to the cost; add another cent for commission, and also United States duty, and the wool is brought to 20 cents a pound, independent of freights and insurance, which will carry it to about 2 shillings. The United States can produce wool of much better quality than the coarse South American article, at this price, and realize a profit.” The cost of production of wool in the Northern United States, including all expenses and 7 per cent. for price of land, and sheep, is estimated at about 27 cents per pound, and that of the Southern States less than *one-third* of this. This speaks strongly in favor of our Southern States as competitors in the markets of the world for wool. Dr. Randall, after reviewing the wool production of the European countries, and Australia, says that “no part of the Eastern Continent, or its islands, all things considered, possess equal advantages for wool-growing with some parts of the United States; the climate of many portions of the latter (in the South) is not excelled by the most favored situations in Hungary, or Australia, and in this respect is decidedly superior to the south of Russia; the soils of vast sections in the United States, with the above climate, are more *uniformly* fertile and adapted to pasturage than those of either Hungary or Southern Russia, and as a whole are entirely superior to those of Australia; the regions alluded to in the United States are better watered with running streams than either of the other named countries—have not the vast and unhealthy morasses of Hungary, and are not subject to the destructive droughts of Australia; the land is cheaper in the United States than in Australia, and (my impression is) than in Hungary and Southern Russia, and labor costs no more in the Southern States than in the two latter, and far more in the former; in accessibility to the great *European* wool market, the United States stand on equal terms, at least with Hungary and Southern Russia, and the distance from Sydney, Australia, to London is nearly *four times* the distance from New York to London; in *no respect* do either of these countries, the most favored of the Old World, excel, in my judgment, for the purposes of sheep husbandry, large portions of the United States; and I believe those portions of the United States can sell wool in the English market on all the capi-

tal invested at a better profit than either of the above countries, with the possible exception of the most favored portion of Hungary. Our surplus wool can, therefore, at any time be exported to England at a reasonable profit. This is true of wools grown even in the Northern States."

Our wool has been exported to England, and its quality and style have been highly praised by the English press, and are understood to have given high satisfaction to English manufacturers, though it was objected that it had not been properly started and properly prepared to meet the requirements of the English market. The price when this trial was made of exporting American wool to England was in 1875, 1876, and then the prices current were 32 cents per pound, showing that the Northern States could receive remunerating prices in England—how much more the Southern States, where the expense of production is *one-third* less than in the former States?

Dr. Randall says: "I see not, therefore, a shadow of reason why the Southern States might not embark at once with perfect safety in an extensive production of wool, *if they only had a foreign market to look to*. I hesitate not to assert that they could drive all European nations from the market, with two or three exceptions heretofore specified; and with these, as well as the Austro-Southern oriental regions, they could maintain a successful competition, and the same of the Austro-Occidental regions of America. And it is difficult to foresee the ultimate extent of this trans-Atlantic demand for wool. Vast portions of the Old World, in those zones where wool must eventually become the principal article of clothing, are just been stepping within the verge of civilization, just laying aside the skins and peltry of the pastoral nomad, and the savage hunter, for garments of cloth. In 1771 England imported 1,829,772 pounds of wool; in 1840 the import was 52,959,221 pounds. But in 1871 the export of woollens was £4,960,240, and in 1840 the export of woollens was £5,652,917, and of woolen and worsted yarns was £3,796,644 . . . ; this shows the export bears no relation to the import, and shows how the consumption of woolen goods has increased." But the American wool-grower is not compelled to look to foreign markets, unless he greatly increases his own production, and continues to increase it with the rapidly increasing population. It is estimated that the number of sheep in the United States are from 35,000,000 to 40,000,000, yet these have never supplied the demand of our manufactories alone. In the year 1880, the United States imported unmanufactured wool to the amount of \$20,945,962, against \$10,788,216 in 1879—and much more than this is imported in manufactured woolen goods. (Treasury Department, Document 109, Bureau of Statistics.) Now, it is evident that there is a great field for wool-growing and woolen manufacturing in the South. Carefully prepared estimates prove that the South can produce wool at 8 cents per pound, and in some instances in favored localities for decidedly less. We have the capital, we have the facilities, without stint for propelling machinery and for furnishing the raw material. How long will the South, and our own State particularly, continue to slumber on, and neglect so great advantages. Woolen factories in the North are very numerous, and the business extending; the dividends amount to from 10 to 15 per cent. Our people generally know nothing of manufacturing, and do not wish the trouble, and, as they may think, the risk of the undertaking. The Southern man can as readily acquire the knowledge as a Northern man, and colored men could readily be converted into operatives by selection of the most intelligent of them. Joint stock companies of farmers can be formed, and a company may well start with a

capital of \$25,000 or \$30,000, and a building should be erected under the supervision of a skillful machinist, and an experienced superintendent should be employed from the North, or elsewhere. We have already some considerable number of woolen manufactories in Virginia, and some turning out excellent goods of high grade, but we suppose there are more woolen factories in the single State of New York or Pennsylvania than in the whole of the South.* It is apparent, then, that we have nothing to fear in competition with other countries in the production of wool. What effect the new discovery and preparation of the "Cosmos fibre, or Vegetable wool," may have on the price of wool remains to be seen. Our consul, H. Lewis, Esq., at Dusseldorf, Germany, gives an account of this remarkable discovery in the Reports of the Consuls of the United States on the Commerce, Manufacture, &c., of their Consular Districts, January, 1881. The process consists in reducing a certain vegetable substance into a fiber, which can be successfully used as a substitute for wool, or flax. The Consul says "the general adaptation of this material to the manufacture of textile fabrics can hardly be questioned, and must be regarded by those engaged in textile industries as a revelation that may lead to results of the highest public importance. The inventor of this process, Mr. Newmann, discovered a chemical process by which the fundamental difference between vegetable and animal fibre is removed. The difficulty in mixing wool with cotton and the vegetable fibres arises from the fact of the different natural structure, the vegetable fibre being straight and smooth, while the animal fibre is curly and crinkled—this caused them to take dyes differently and to be difficult to be milled and fulled together. This new process curls and crinkles vegetable fibre, which it permanently retains and causes it to be properly dyed with wool, taking readily the same, and equally fast colors by one and the same process. The cost of producing this fibre is but a small fraction of the cost of sheep's wool, and it produces a material vastly superior to 'shoddy,' and is not only much cheaper, but is capable of many more and important uses in the manufacture of cloths, blankets, flannels, hosiery, and many other articles, and is strong and durable." A sample of the cloth has been sent to the Department of State in Washington. The Consul says "a company has been formed in Dusseldorf, the 'Cosmos Fibre Company,' and that samples of their cloth, made wholly or in part from Cosmos Fibre, which in color, fineness, homogeneousness, and strength of fibre, will stand the severest criticism. The colors of the samples exhibited, and which consisted of two-thirds of this fibre and one-third wool, were brilliant and perfectly blended, and experts would find it very difficult to tell which was wool and which vegetable fibre. Many manufacturers in Germany, France, Belgium, and Italy are taking a lively interest in the new invention, and are preparing to introduce it into their woolen manufactories. . . . New companies are being formed for manufacturing Cosmos cloth in England, France, Belgium, and Algiers."

We mention this subject both because of its interest and because of the possible influence on the production and price of wool. We should think it could not be a substitute for wool in cold climates and where warmth is desirable; and there are so many persons in the world imperfectly clad, so rapid increase in population, and so great extension of commerce, that it will probably be long before woolen fabrics are much cheapened. If they should be, it will be a blessing to many, and the wool-growers of Virginia and the Southern States can afford to have

*At the time of writing this we have not access to the United States Census, which is very tardy in being published—(coming out in fragments.)

prices lowered when we remember that we can produce wool at 8 or 10 cents per pound. Still we should be watching the results of this discovery, and if this cosmos fibre is a success, why should we not in Virginia avail ourselves of its benefits, establish factories, and work up our wool with this fibre, which in all probability we can raise here, and prepare for the looms?

Mr. Hayes, in his "Sheep Husbandry," in reply to the enquiry, "Is there any reason in a probable glut of the market from an enlargement of the area of production which should deter a Southern farmer from embarking in wool growing? And to this enquiry we unhesitatingly answer no. The fears of over-production which give the disciples of Malthus and Ricardo so much apprehension are rarely realized, except in the great staples of manufacture. Production usually limits itself by its own operation. Thus California, it is said, has reached the limit of its wool production, by occupying all its pasture grounds, or by converting them from the domain of the crook to that of the plow. Lands in Vermont, Ohio, New York, and Michigan, first improved by sheep, have become too valuable for growing sheep for wool mainly; and these States are becoming the producers of sheep for mutton, and combing wool, and rams for breeding. High production of wool in one quarter of the world is usually attended by diminished production in another. While Australia has increased the number of her sheep so wonderfully, Germany has fallen off from 50,000,000 in 1850 to 25,000,000 at present, and France from 32,000,000 in 1839 to 24,000,000 in 1872. . . . The consumption of clean wool in the United States is set down for 1875 at 4½ pounds per head of our population. This is far short of what we ought to consume for the required comfort of our whole population, and what we would consume if the producing and consuming power of our people were adequately developed. It is doubtful if half our population wear the woollen under-clothing required for health and comfort. Persons well informed in the trade in articles of this description have made the following curious estimate :

"With a population of 35,000,000 (in 1870—now 50,000,000) we may suppose there are 8,000,000 who from poverty, mildness of climate, or other causes do not wear stockings; leaving 27,000,000 who will use at least 3 pairs per annum, requiring 81,000,000 pairs, or 6,750,000 dozen, which, at the value of \$3 per dozen, would be \$20,250,000. Estimating that there are 18,000,000 males, one-half of whom will wear knit shirts and drawers, and allowing one shirt and one pair of drawers to each of the 9,000,000 males per annum, 1,000,500 dozen will be required, at \$12 per dozen, of the value of \$18,000,000. Estimating that there are 17,000,000 females, one quarter of whom will wear under-vests and drawers, and allowing only one garment to each, 375,000 dozen, at \$12 per dozen, of a total of \$4,500,000, will be required, making the whole value of the above staple goods alone, required for American consumption, \$42,750,000."

This statement illustrates how slight an increase of the consuming power of our population is required to expand the wool manufacture, and to create a home demand for the raw material such as never existed. But the production of wool at the South will be so gradual in its increase that it will be a long time before it has any sensible effect upon the markets. It should be gradual to be healthy and natural. It should spread through the example of intelligent and cautious farmers. A general and sudden enthusiasm for sheep husbandry at the South would be as

undesirable as the *morus multicaulis* and silk mania of 1839, which stopped the silk culture in many of the Southern States, where it might otherwise be now successful. . . . We would allure them to an industry more certain of remuneration from a moderate investment than any other which can be so easily introduced upon their farms, and that is far more important, an industry which will be the precursor of that diversified culture through which alone agriculture can be made permanently profitable.

EFFECT OF FOOD IN THE PRODUCTION OF WOOL.

Of course we should expect that well fed sheep will produce more wool than those badly fed. But it is desirable to know, if sheep are kept in good order, whether one kind of feed will produce more wool than another. Animal tissues derive their chemical components from the same components existing in their food. Analyses prove that wool, hair, hoofs, feathers, lean meat, blood, nervous and cellular tissue have nearly the same composition. The organic part of wool (Johnson) consists of carbon, 50.65; hydrogen, 7.03; nitrogen, 17.71; oxygen and sulphur, 24.61. The inorganic constituents being small, the ash being only 2 per cent. As we would suppose, the large quantity of nitrogen contained in wool would require a liberal quantity of nitrogenous food, and in practice the amount of wool bears a direct proportion to the amount of nitrogen in the food. Experiments were made on Saxon sheep in Silesia by Reaumur, who prepared a table showing the results (found in Randall), from which we quote: 1,000 pounds of raw mangel wurzel, containing 0.21 per cent. of nitrogen in the food, gave an increase of weight in the sheep of 38 pounds, produced 5 pounds 3½ ounces wool. Wheat (1,000 pounds), containing 2.09 per cent., increased the weight 155 pounds, and produced 13 pounds 13½ ounces wool. Peas (1,000 pounds), containing 3.83 per cent. nitrogen, increased the weight 134 pounds, and produced 14 pounds 11 ounces wool. Rye (1,000 pounds) *with salt*, containing 2 per cent. nitrogen, increased the weight 90 pounds, and produced 13 pounds 14½ ounces wool. Rye (1,000 pounds) *without salt*, containing 2 per cent. nitrogen, increased the weight 83 pounds, and produced 12 pounds 10½ ounces wool. Oats (1,000 pounds), with 1.70 per cent. nitrogen, increased the weight 146 pounds, and produced 9 pounds 12 ounces wool. Buckwheat (1,000 pounds), with 2.10 per cent. nitrogen, increased the weight 120 pounds, and produced 10 pounds 4½ ounces wool. Barley (1,000 pounds), with 1.90 per cent. nitrogen, increased the weight 136 pounds, and produced 11 pounds 6½ ounces wool. Good hay (1,000 pounds), with 1.15 per cent. nitrogen, increased the weight 58 pounds, and produced 7 pounds 10½ ounces wool. These are instructive facts. They show the strict relation between the amount of wool and amount of nitrogen in the food, and the great value of peas not only in increasing the quantity of wool, where they rank *first*, but in the average comparative increase they cause in all the tissues. It is a little singular that barley containing less nitrogen than buckwheat, should produce more increase in weight and more wool.

BREEDING AND CROSSING.

There are varieties of opinion concerning the best breeds to cross upon, how far crosses should be carried, and even about the propriety of crossing at all. Though we see in the country some of the finest varieties in animals of all kinds now in

existence,* as the result of crosses, there are those who bitterly inveigh against the practice, under all circumstances. In some cases, where objects incompatible with each other are sought to be obtained, failure has been the result, but failures are to be expected in every business where judgment and foresight are wanting. It is of prime importance for those commencing flocks of sheep to select the *choicest rams*. When the number of a ram's progeny is taken into account, and when we reflect to what great extent his good or bad qualities are to be perpetuated, the folly of a false economy which would induce one to purchase an inferior animal must be evident to all. The ram gives character to the entire flock, and the ewe only to her own offspring—nevertheless much care should be taken in culling out and selecting the best ewes, a matter only second in importance to the selection of the ram. The ram should be of pure blood of his kind; more attention should be paid to his form and the character of his wool than to his size and weight, large fat rams not being best, a good thrifty growing condition being much preferable in both rams and ewes than fatness. Should mutton be the object, one should be selected with compact body, small boned legs, small head, full arms and thighs, close wool, fat on the ribs, with a general good make-up and appearance. Large bone and long loose frame must be avoided. The ewes should have large bodies, broad across the hips, be good feeders, of good constitution, and of gentle disposition. If attention is paid to the ewe being broad across the hips, the pelvis will be large and roomy, and the lambs will be more easily brought forth without danger of losing the lamb and the mother. The ram should not be used too young, and should not serve more than twenty-five ewes until he is at least two years old. He should have some rich nourishing food in addition to pasturage, while the ewes will not require anything but pasturage until about two weeks before lambing, when bran and oats, or corn and bran or meal, should be given. To perfect a flock of sheep requires great attention, perseverance, and watchfulness. The young breeder is sometimes discouraged at the slow progress in obtaining the desired improvements, but he must remember how long it has taken experienced breeders, Bakewell for instance, to attain their ends, and how difficult it has been to raise fleeces from four to six pounds up to double these amounts. The breeder must fix in his mind the nature and character of the flocks he desires to form—must determine whether he is to make mutton, or wool, or lambs his primary object. He must watch his flock, separate, and breed only those possessed of the desired qualities to rams selected whose best points are where the ewes are most defective. All this care, and fifty years or more of attention has been devoted to perfecting the Merino, Southdown, Cotswold, &c. If the breeder has a flock which possesses the desired characteristics he must adhere to the breed, and select better animals to improve his inferior ones, but if he desires to obtain qualities not characteristic of his sheep, he must cross with a breed that does possess them. If he possesses Southdowns or Cotswolds, and wishes to convert them into a fine woolled sheep, he must cross steadily with Merino rams, constantly increasing the Merino blood and diminishing the other. The same course may be taken with the common sheep, or any other coarse race. It is not within the means of every one wishing to start a flock of sheep to start entirely with full bloods. By purchasing a few full blood rams he can carry the cross so as to make the breed practically full blooded. By crossing Merino rams on common sheep, or on Southdown when

* The Improved Kentucky, New Leicester or Bakewell, Cotswold, &c.

$\frac{7}{8}$ Merino is attained the wool will be good Merino. In the case of the Southdown, some of the mutton quality will be retained.

Mr. Livingston says: "It is now so well established as not to admit of the smallest doubt that a Merino in the fourth generation from even the worst woolled ewes is in every respect equal to the stock of the sire. No difference is now made in Europe in the choice of a ram whether he is full blood or 15-16. . . . The French agriculturist says however coarse the fleece of the parent ewe may have been, the progeny in the fourth generation will not show."

How far "in and in" breeding should be practiced is a matter of dispute among breeders. There is no doubt that excellency of breeds has been attained by selections of the best, and breeding "in and in" until great perfection has been obtained with fixity of type and with origin of a species. At the present day there are writers who hold up for "in and in" breeding, and call for instances to be pointed out of evil results. No doubt such instances have occurred, and we are continually pointed out what are asserted to be such results in the human race. Such a generally believed opinion of the evil effects of "in and in" breeding would hardly prevail without a foundation in fact, and there can be no doubt that it is a fact. In the human, however, the selection of the fittest is not made. But with the greatest care in the selection of animals, there may be defects of constitution which cannot be perceived. If those nearly allied are bred together, and this unperceived defect or idiosyncrasy exist in both parents, their offsprings will possess this defect in a double degree, and supposed this interbreeding is kept up for several generations, this predisposition to disease, in the first place slight, will be constantly growing stronger, and will become incorporated into the constitution of the whole flock, and the first time the requisite exciting causes are brought to bear the disease may break out with great destructive effects, or it may be more slowly acting and become chronic, occurring at intervals with gradual depreciation of the flock. Those who have given the subject attention assert that such are the common effects of "in and in" breeding, and the practice is now looked upon with disapprobation by a large majority of Northern breeders, practical, observing farmers. This does not refer to "in and in" breeding to a small extent, where persons own fine animals of evidently hardy, robust constitutions, and wish to transmit their good qualities for a few generations. We did not mention that defects of form, slight in the beginning, and escaping detection, may also be transmitted in the same "in and in" breeding. The general belief now is that Mr. Bakewell carried his "in and in" breeding too far, and that the general appearance of the Leicesters he originated, and a disposition to scrofulous disease observed in them tend to confirm this opinion.

PRACTICAL OBJECTS IN CROSSES.

Every breeder has his objects in wishing to cross his flocks. The proximity to markets will decide him whether he should cross for mutton or wool, or partly for both, and for lambs. If for wool, Merino rams should be used on common ewes, or long wool sheep. If the market calls for high grade mutton, the Down possesses decided superiority, and we must use the ram of this breed to transmit the mutton qualities. If lambs are to be raised for market, the larger breeds are preferred on common ewes, but the Merino has many advantages in crossing on the Southdown or Cotwolds, or even on common good size, well selected ewes.

Though smaller, it is remarkable for vigorous constitution, and for tenderness and juiciness of its meat. The Southdown lamb will attain its growth quicker, and is larger than the Merino cross, and the black face lambs are always popular with the butcher. Whatever plan the breeder adopts he must continue in the same course, unless he finds he is not accomplishing good ends. He must continue with rams of the same breed, changing them every other year, which he may generally do without expense by making an exchange with his neighbor, thus benefiting both. The ram lambs must be sold and the ewes retained, taking great care to keep only those free from any defect, and then if they prove poor milkers let them be put with the old ewes and sold to the butcher. And when the farmer has enough ewe lambs for breeders he can sell off the original native stock, leaving his flock with half-blood grades of Southdowns, Merinos, or whatever cross he adopts. If the farmer wishes to convert a flock of native ewes into long woolled sheep, the Cotswold or Leicester will answer his purpose.

There are limitations to cross-breeding of sheep. Not long since an enquiry was addressed to Mr. John L. Hayes, the well known writer on sheep husbandry, from a gentleman who is extensively engaged in sheep growing in Western Kansas, seeking information on the subject of cross-breeding flocks of Merino blood with long-wool Leicesters and Cotswolds, with the view of growing the cross-bred for combing purposes, so popular in the market. Mr. Hayes, in a letter dated January 20, 1881, and published in the "Shepherds' National Journal," says "The case presented is that of a grower of sheep on an extensive scale, in flocks of a thousand head, or more, situated at a distance from large cities, and having no market for mutton or lambs; pursuing in fact the purely pastoral system of sheep husbandry, for the production of wool as the main object, the flocks being of Merino, or with a predominance of Merino blood. It is, in short, the case of the general wool growers on the plains in Colorado, Wyoming, Montana or Texas. The question is whether these wool-growers advantageously incorporate the blood of the long-wooled Cotswold and Leicester races into their Merinos, or grade Merinos, with the object of producing the cross-bred wools, which are perhaps often more marketable, and certainly more abundantly produced." Mr. Hayes then proceeds to say that "he had long consultations on this subject with Mr. F. W. Schaeffer, of Texas, a gentleman of education and intelligence, and one of the most successful growers in that State, having a flock of over fifteen thousand head. Mr. Schaeffer stated to me that the result of his experience and observation on sheep breeding was that the crossings of Cotswolds—he did not speak of any other race of long-wooled sheep—upon large Merino flocks was decidedly disadvantageous. His principal objection was that such crossings, if continued for any length of time, makes the wool very uneven, destroying the uniformity of clip, and distinct character of wool, which it is one of the first aims of the intelligent flock-master to secure. Another objection was with a preponderance of Cotswold blood the sheep do not herd so well, the habit of the Cotswold being to scatter in the pasture, while the Merinos keep compactly together while feeding." He then says he had met Mr. Bergimer Flint, a noted wool-grower of California, whose flocks belonging to himself or the company of which he is the elder partner, had sometimes exceeded 100,000 head—that he had seen Mr. Flint at the "International Sheep and Wool Exhibition in Philadelphia," and noticed the deference paid by practical breeders present to his remarkable skill and judgment in pronouncing upon the qualities of sheep. I may say that I had observed the

same thing on this occasion. Mr. Hayes said he questioned Mr. Flint very particularly in regard to his experience in California upon the question of cross-breeding the long-wooled sheep upon the Merinos, and if any success had been attained in forming permanent flocks which possessed the qualities of both races. Mr. Flint: "This object has been the dream of sheep-breeders almost from time immemorial. Attempts of this kind have been made everywhere in California, and always without success. Growers have invariably had to breed back to eradicate the long-wooled blood infused into their sheep; the time has been worse than lost in these experiments." He was speaking of the large flocks of Merino foundation, let it be understood, kept on the natural pastures with the object of growing wool, and not of the comparatively few cases where the object had been to form an entire flock of long-wooled and mutton sheep. The observations of Mr. Flint are confirmed by Mr. M. D. W. Ap. Jones, an experienced sheep-grower of California. He states that the growers of California who had introduced the long-wooled blood into their flocks had been compelled to eradicate it. This settles, then, the question of attempting to improve the *wool* of the Merino with crosses of the long-wooled sheep. Mr. Hayes states, however, that Mr. McKellar, a practical sheep-grower of Australia, informed him that the celebrated cross-bred wool of that country is the result of crossing Merinos with Lincoln rams, though the cross-bred quality is intended in time to entirely disappear. In times of special activity in the market for such wool, especially of late years, the product of the first cross was very profitable, but if continued the uniformity of the wool was lost and the flocks became deteriorated. The experience in Australia was that a permanent flock should be formed of a single race, kept as pure as possible—the Merinos for natural dry pastures, and the long-wooled sheep for the rich lands and high culture. Mr. McKellar stated that the climate of New Zealand corresponds so nearly to that of England, and the turnip culture is pursued so easily, that the English race and methods of sheep husbandry are found even more advantageous than in the parent country. This probably accounts for the partial success of crossing the long-wools on the Merino, but even there it seems to be practiced to a limited extent and to meet special demands for cross-bred wool.

MANAGEMENT OF SHEEP.

We are disposed to believe that the principal cause of failure and disappointment of some who have embarked in sheep husbandry has been the want of proper management of flocks. Some have conceived the opinion that sheep are very easy to raise, that they require little attention, and will take care of themselves. The fact is they require less attention than other stock, but that does not amount to their taking care of themselves by any means. They are a meek, quiet, uncomplaining stock, their wool frequently hides their leanness, and they will browse along on the poorest herbage, making some sort of living, until they are taken with disease or perish from cold from want of sufficient nourishment. Hogs and other stock will make their wants known; hogs squeal and grunt when hungry, and they and cattle will break into corn and clover fields and other places until their appetite is satisfied, while the poor sheep are taking it quietly, and making the best living they can from the pastures into which they are placed.

On this subject Mr. John A. Young, of North Carolina, in a letter addressed to Mr. John L. Hayes, (see Appendix "Sheep Husbandry for the South,") says:

"Twenty years' experience in manufacturing the wools grown in the State has familiarized the writer with the manner in which our sheep have been cared for, and has convinced me that without great natural advantages their utter neglect would long since have exterminated them from the soil. There are few plantations in the State upon which there was not to be found a flock of sheep intended to be only sufficient to furnish the wool necessary to clothe the family and furnish an occasional mutton. These sheep were generally the native breed, rarely improved by crosses on foreign blood. As a general rule, these small flocks never entered into the owner's estimate of his valuable property, and they were never so treated. In the spring they were shorn of their fleeces, and turned outside their owner's enclosure to seek their summer support in the forests, and waste lands over which they chose to roam, and to run the gauntlet for life among hungry hounds and gaunt curs almost as numerous as themselves. All that might escape, and were able to find their homes in the fall, were admitted within the gates and permitted to eke out a scanty living in the denuded fields, and corners of worm fences, which is supplemented by a morning and evening allowance of corn fodder. . . The only protection against the rains and occasional storms of winter afforded to a majority of these flocks being such as their instincts lead them to seek by hovering on the sheltering sides of barns and outbuildings that may be accessible; a tumble-down or waste-house on a plantation is a perfect asylum for them. Yet under this treatment the flocks of the farmers keep their numbers full and occasionally multiply beyond their wants. Of necessity their fleeces are light and inferior. Whenever an effort has been made to improve the stock by crossing on Merino or other improved blood, the effect is satisfactory and lasting. From the universal custom of turning the entire stocks into the common "range," the impression of a Merino, Southdown, or other importation would manifest itself upon the flocks of entire neighborhoods. So apparent is the improvement thus made that in purchasing the surplus brought to market there would be no difficulty in recognizing the wool from a neighborhood that had been favored by some enterprising farmer having imported from Virginia or Pennsylvania a pair of blooded animals. Without any change in the mode of treatment, these improvements are known to be distinctly manifest in neighborhoods thirty years after their introduction."

We have copied this paragraph because the treatment of flocks in Virginia is, in many instances, of like character, and as evidence that sheep are greatly neglected, under, we suppose, the prevailing opinion that they can take care of themselves. They can shift for themselves better than almost any other animal, and can stand much exposure to cold, but all animals require proper food and protection in our winters.

WINTER MANAGEMENT.

The two important things in winter management of sheep are proper feed and proper shelter, the amount of each depending on the severity of the winters and the different regions in the State. In Tidewater Virginia there are frequently thick clumps of pine and cedar, and sometimes thick undergrowths of other varieties, under which the sheep will find good shelter under ordinary circumstances. But it is always safe to furnish them with shelters open to the south, and permit them to take their choice of shelter or open living. If natural shelters are to be

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trusted to they must be supplied with an abundance of good nourishing food. Sheep when supplied with shelter will often refuse it, preferring open pasture; but this is when they are furnished with good, substantial food. In many of our winters sheep cannot thrive with cold rains and snows beating on them, and wetting them to the skin. In selecting a place for sheltering sheep, rising ground should be chosen, so that water will flow off readily, avoiding a north hill-side. If no such eminence can be had on the farm, a southern exposure should be selected, and drains be made from the grounds to carry off surplus water, and embankments should be thrown up around the sheds on the outside to prevent the access of water. Sheep cannot be kept in a healthy condition with wet feet all the time, and in addition to the precautions mentioned, we must always avoid selecting a low, marshy spot. Sheep on wet lands are subject to foot-rot, sometimes a terribly destructive disease. Over the shelter it is well on some portion to erect a steep roof to afford shelter for provender for the sheep, and gutters to carry water from the yard. Troughs and racks must be provided under the shelters for feeding. We do not require the close and costly barns of the farmers in our Northern States; but shelters are essential to protect sheep from wet, and the deep snows and cold weather we sometimes have. Cleanliness must be observed in these buildings and yards, and the floors where the sheep lie must be littered with straw or "pine tags" for bedding. Once, or better, twice a week they should be cleaned out, and a heap made that the decomposition of the bedding may be hastened, but this manure pit must be outside the enclosure, that the sheep may not lie on it, to which they may be attracted by the warmth of the fermenting manure. This manure should be closely saved, which is rarely done, because it is among the most valuable, if not the most valuable, of all manures, particularly when the sheep are fed with rich food. One advantage of this manure is that the mastication of the sheep is so perfect that no seeds of weeds vegetate from it, and the urine is also very valuable. According to analysis, in 100 parts of sheep dung there are 19.3 per cent. of animal and vegetable matter and 12.7 per cent. of saline matter, and 19.3 per cent. contain as much nitrogen as 43 parts of horse dung, 63 parts of hog or 125 parts of cow dung. It is much drier than other manures, having in comparison with them but little water, and from its coldness does not easily ferment like they do, and retains its ammonia (the most valuable portion) much longer than the excrement from horses and other animals. When sheep are fed on oil cake it adds not only greatly to their fattening properties, but it is an addition to the value of their manure. The oil cake is greatly esteemed by all who have tried it, and it is highly esteemed in England, and for this reason it is much shipped there instead of being used here at home, our people being content to use whatever they have in the form of manure, regardless of its quality. The manure from cattle or sheep fed on oil cake is so much enriched that it can be spread on much increased surface, and with much better results than can be obtained from other manures in larger quantity, with better immediate results and with much more permanent effects. Sheep, too, distribute their manure evenly over the fields much more than can be done by artificial spreading, so that every plant receives its due proportion, showing an even and luxuriant growth. Winter quarters for sheep of course must, in size, be in proportion to the number of sheep. They must not be crowded. In the northern States ten feet square is usually allotted to each sheep, but here where the shelter is only required at night and in very bad weather, a shed twenty feet by fifty feet is large enough for 150 sheep,

unless the bad weather is very protracted. They should be admitted to the fields or to large yards in the day, when they see fit to use them. It is an excellent plan to keep the sheds well bedded with straw, both on account of the sheep and for manure making. This catches the manure droppings and the urine. This should not be permitted to accumulate too much before it is removed, always remembering to keep the sheep dry, particularly their feet. In making racks for sheep, the bars must be made so close that the sheep cannot get their heads through or so far apart that they can readily pass the head in and out, for fear their heads may be hung and the animal be choked to death; and the ends of the racks should have bars placed across them so as not to let the sheep get in and be entangled between the bars.

Sheep generally should not be fed or run with other stock; cattle will gore them and colts and horses tease and injure them. Some persons however get them accustomed to running with cattle as a protection from dogs.

FEED FOR SHEEP IN WINTER.

The proper dry winter feed for sheep has been much discussed. In Germany they practice elaborate systems of feeding, and insist much on the necessity of variety in feed, varying with all kinds of hay and straw, and with beans, potatoes, artichokes, carrots, beets, bran, &c. Luckily, the Southern farmer can have no lack in variety of feed if he will take a little pains to procure it, but many rely on hay, or fodder with a little corn, some even on straw, and perhaps one ear of corn for half a dozen sheep at a feed. We can have rye, and winter oats, and orchard grass, and in some sections blue grass for winter grazing, and we can raise pea-vines, fodder-corn cured or by ensilage, besides clover, and the various hays, and corn, oats, beans, peas, cotton seed and oil cake, bran, meal, and the various roots. turnips, krangel, wurtzel, carrots, rutabagas and beets. We are disposed to think some hay, fodder-corn (particularly ensilaged), rye and oats seeded in August for grazing, with some meal or corn, bran, shelled oats, and some turnips will be all the feed we can need for winter feeding, and probably the ensilage with bran and meal will do away with the necessity for all root crops, which are hard to raise in our latitude. Sheep suffer from constipation, and the roots obviate that, but very probably the ensilage and bran will answer the same purpose, particularly if a little epsom salts be occasionally combined with them. Still, roots are very useful, and the English farmer thinks he cannot get along without them. It costs us much more than the English to raise them.

We have already spoken of the management and fattening of mutton sheep. For feeding stock sheep, and indeed all sheep and stock, we should know something of the value of the different kinds of food. We give the following tables, found in Dr. Killebrew's treatise, showing the relative value of the different kinds of food based on their nutritive qualities. This is an important matter, particularly where the farmer has to buy his supplies for maintaining and fattening his sheep when he cannot obtain them on his farm. The annexed tables will be of much value to such an one, and to farmers generally:

In 100 parts of—	Water.	Ash.	Organic matter.	Flesh formers.	Fat Starch gum.	Cruded fibre.
Meadow hay.....	14.3	6.2	79.5	8.2	41.3	30.0
Red clover hay.....	16.7	6.2	77.1	13.4	29.9	35.8
Pea straw.....	14.3	4.0	81.7	6.5	35.2	40.0
Bean straw.....	17.3	5.0	77.7	10.2	33.5	34.5
Wheat straw.....	13.3	5.5	80.0	2.0	30.2	48.0
Rye straw.....	14.2	3.2	82.5	1.5	27.0	54.0
Barley straw.....	14.3	7.0	78.7	3.0	32.7	43.0
Oat straw.....	14.3	5.0	80.7	2.5	38.2	40.0
Corn fodder.....	14.0	4.0	82.0	3.0	39.0	40.0

These analyses are taken from the hay cut in the blossom. If allowed to get fully ripe, the crude fibre is largely increased and a corresponding depreciation of the fat and flesh forming principles ensues.

Comparative Value as to Nutrition of the Same Materials in One Hundred Parts Taking English or Meadow Hay as a Basis.

Meadow or English hay.....	10.0
Clover hay.....	12.5
Pea straw.....	16.5
Bean straw.....	18.6
Wheat straw.....	2.0
Rye straw.....	1.6
Barley straw.....	2.0
Oat straw.....	1.3
Corn fodder.....	2.5

Now, in order to produce the same nutrition in an animal that ten pounds of meadow hay would give, there will have to be fed of—

Clover hay.....	8 pounds.
Pea straw.....	6 pounds.
Bean straw.....	5½ pounds.
Wheat straw.....	52 pounds.
Rye straw.....	61 pounds.
Barley straw.....	52 pounds.
Oat straw.....	55 pounds.
Corn fodder.....	40 pounds.

There must surely be a mistake here concerning the fodder from corn. Dr. Killebrew says the table is from Prof. Way, who candidly admits that the fodder is *under-estimated*, and proceeds to remark: "It will be a difficult matter to persuade our Tennessee farmers (and we will add our Virginia farmers) that this fodder is four times less valuable than hay, as many of us believe it almost equal, and many that it is superior to any kind of hay." We may add in confirmation of this last opinion, that *racers* prefer fodder to any kind of long food for their horses, which have to be subjected to such severe contests of speed and endurance. Dr. Killebrew says in reference to feeding value of straw, "It becomes apparent from

the insight given by these tables that our usual methods of depending on a pile of straw to feed cattle or sheep is a very precarious way of keeping them in order or even alive. It is true that straws have a value, but just think for one moment of the amount of straw that must enter a sheep's stomach to enable it to live. It would be impossible for a sheep to consume ten 'pounds of hay in a day, and yet to procure the same amount of nutriment that sheep must eat 52 pounds of wheat straw, 62 pounds of rye straw, and of oat straw* 55 pounds. It is very evident from this tabulation that if they had no other food they would starve to death. With the addition of grain or some other of the more concentrated forms of food they can do very well with a constant access to the straw pile." Sheep only pick large amounts of straw over, getting the blades, while the mass of the straw is useless to them.

Breeding ewes must be fed liberally after lambing, but much rich food before lambing may make them lose their lambs by premature birth, and may cause them to cease to breed. It is best to change their food and give them no more rich food, than they will eat up clean. A constant supply of salt and fresh clean water are necessary for sheep, and a mustard patch furnishes a fine stimulant to the stomach during the winter.

Feeding grain to store sheep in winter is not generally necessary, provided the sheep are well supplied with good hay or fodder. Near markets, where grain commands a ready sale, it is not usual to feed grain. Remote from markets, it is generally fed by holders of large flocks. Oats, a gill per day, are usually preferred. When corn is fed, half gill per day is usually the quantity. In very cold weather, it is a safer policy to feed some grain to all sheep. It prevents their getting thin, and in low order, and increases their fleece in weight. When grain is not given, hay should be furnished them three times a day, or cut oats once a day and hay twice. In a climate where they can obtain grass or other green food, the grain is unnecessary. But frequently in the winter they cannot get grass enough, but sometimes probably enough to take away their appetite for dry hay, and then a little grain is necessary—oats, corn, or peas, of which they are fond, and which are very nutritious. In feeding corn, it is important not to feed too much, as it is too hot and stimulating for sheep except in moderate quantity, and they are more apt to cloy and sicken on it than on oats or peas. Randall records an instance where sheep were fed by a Northern farmer on good hay and half gill of corn per head per day. They were in good order and doing well, but *during a thaw* they "got off their feet," and the shepherd without the owner's knowledge increased the feed of corn, as he said they looked "hollow." This caused them to eat still less hay, and the shepherd still increased their corn, as their appetite for hay diminished. Their stomachs became so deranged they would not eat *anything* in quantities sufficient for their nourishment, and they perished rapidly and miserably. Dr. Randall says he does not consider *yellow corn* a very safe feed, at least for lambs and yearlings, and suggests that the larger varieties of Southern corn would be preferable and safer. He says: "I presume it would be less, and probably not at all, objectionable for sheep feed." But we know that sheep have been seriously injured, and killed, by too much of this kind of corn, and we presume there is little difference between the two kinds, the yellow having rather more of fat and carb-hydrates, heat-producing elements. It will not do to allow sheep to

* We think the oat straw is underestimated, being worth more than wheat straw. Straw is much more valuable if it is put under shelter and protected from rains and snows.

get thin in winter, thinking their condition can at any time be put right by good feed, as in the horse and ox. When sheep get *weak*, and particularly sick, they do not seem to have the power of resistance and recuperation seen in other animals. When in this condition all extra feeding must be very gradual, and if a full allowance of grain be suddenly commenced very probably fatal diarrhoea will set in. It is said that sheep will eat cotton seed meal and thrive on it, and of course it will increase the value of their manure.

Regularity in feeding sheep is very important. Very observant farmers have noticed that however well provided a flock may be, if the feed be given irregularly, sometimes twice a day and sometimes three times, sometimes grain one day, and none the next, they will not thrive. The best times for feeding are about sunrise, noon, and about sunset, so that they can eat *before dark*, it having been found that this, like other stock, do not eat well in the dark. It is not very important at which of the three meals grain be given, only that it be given at the same meal each day. Regularity should be preserved in the amount of feed, though of course this varies with the coldness of the weather, for the colder the weather the more in proportion will the sheep eat. In our climate, grass will be obtained in much of the mild weather of the winter, and sometimes through almost all the winter, particularly in Eastern Virginia. At such seasons hay or fodder once a day will suffice. The regulation of the quantity of grain or roots of much more important than that of hay, for sheep will not surfeit themselves with dry food, but with the former they will; and if grain be given freely, they eat less of hay and expect the same amount of grain, and if they do not receive it, become restless and uneasy.

Salt.—Sheep seem to require more salt than other animals. Some feed them with hay or straw with brine sprinkled over it, particularly in warm, thawing weather, when their appetite is liable to become poor. A layer of straw or hay is sprinkled with brine, and then another layer, sprinkling it, and so on. Let this lie a day for the brine to be absorbed by the straw, and then feed to the animals,

Water is indispensable to sheep, and constant access to running clear water is best.

In feeding breeding ewes in winter, it is necessary that they should be kept in good condition; and after lambing, if the weather is cold and they do not have access to grass, they should be fed with chopped roots or ensilaged fodder corn with meal, of which oat or pea meal is best. The ram should be turned to the ewe the last of August or first of September where early lambs are looked for; but where lambs are not the object, as in the colder portions of the State, and where the farmer is not provided with good shelters, then November is early enough, as lambs will begin to fall first of April, and will live if dropped in the fields.

Ewes go five months, and the use of the lamb must be regulated accordingly.

SUMMER MANAGEMENT OF SHEEP.

Before turning a flock out in spring, always tag them to keep them clean, as they frequently scour after being turned on green feed. The wool around the outlet of the bowel becomes saturated with the excretions, which form into hard pellets when the purging ceases, and indeed often without any purging, and this cannot be removed from the wool in the process of washing, and is difficult to remove with the sheers, and is often impracticable to do so without wounding the

animal. Sometimes flies too deposit their eggs under this mass of filth before shearing, and the resulting maggots, unless discovered in time and removed, may lead the sheep to a suffering and disgusting death. The wool should be sheared also from off the entire bag of the ewe, that the young lamb may the more readily find the teat, and also from the scrotum of the ram, and so much around the sheath of the ram as is generally kept wet. This prevents soreness and ulceration and any difficulty in tupping. The wool saved by tagging will pay for the expense of the operation, as it will sell for half the price of the regular fleece.

Washing of sheep before shearing is not much practiced in Virginia; in the Northern States it is almost universal, as it is in England and other European countries. It is more than probable that these calculating and managing people are right, and that their plan must have merits. It frees the fleece from dirt and other impurities that have been accumulating, and causes the wool to sell at higher prices. It is not every one that has the natural advantages for washing, but the northern farmers go to the expense of building vats with plank sides and bottoms for the purpose. If a stream can be obtained with sandy or gravelly bottom, a pen is built on the banks into which the sheep are driven through a narrow alley leading down to the water, terminating by a plank platform, from which the sheep are driven directly into the water. In washing the sheep it must not be lifted by the wool, as its weight will frequently raise the skin from the flesh and produce extravasation, or a bruised appearance, sometimes causing the wool to fall off from these spots. It must be caught by the legs and plunged several times under the water until thoroughly wet, then it is permitted to stand on its legs, and the wool is well rubbed, being opened at the matted portions, and the legs are well washed; then it is passed on to another washer, who stands above him, and well rinsed (the sheep is turned against the current) and then passed into a clean, grassy meadow, first squeezing as much water out of the wool as practicable. To ewes with lambs, if more carefully handled than the others, no harm will result. The sheep are kept in this meadow until dry, which will be in five or six days in favorable weather. Where vats and other appliances are used the washer can stand on a platform, and, with a rubber apron and boots, keep entirely dry.

SHEARING.

The shearing must not be done where washing precedes it until the wool is dry and has had time to exude its natural oil, which gives it an unctuous feel and a bright, lively look. If sheared when dry like cotton, before the oil has reformed, you lose in weight, the wool will not keep so well for long periods, and the shears pass with much difficulty through this dry wool. The shearing must be done with gentle hands and without violence, as the sheep is very timid; the shears must be sharp, and kept so with a good whetstone. The shearer should have a bench or table waist high, which, with the floor, should be entirely clean and smooth so that they will not hold dirt or catch the wool. The shearer, before commencing, must pick off any loose straws or burrs which may adhere to the fleece, and see that the feet are cleaned from any loose dung adhering to them, and that everything around is clean. The shearer with his assistants places the sheep on the bench, with the head of the sheep towards himself, with the sheep resting on the right side, and begins by cutting all the tags off the head, forelegs and belly, which must not be allowed to be mixed with the other wool; then cut over the

sheep's belly, forelegs and backbone as far as it can be reached, then around the hind legs and tail to the first beginning. The sheep is now turned over and soon shorn on the other side, by beginning at the same point and joining the first shorn part. The hand must be kept well away from the sheep's body, and the shearer should never take two cuts at the same piece of wool, for if the fibre is cut twice it is injured; if the flesh is injured by the shears some tar must be smeared over it, or it will be infested with maggots. Shearing should take place in Virginia about the middle of May, or later if the weather is cool or rainy. If sheep are shorn in cold weather they will shiver and probably contract lung disease. A good, warm day should be chosen for the operation. Gentleness should be used, and to keep the fleece entire, so important for its commanding a good price, it is very necessary that the sheep be held in a position to make it comfortable, so that it will not struggle. No man can hold it still by main strength and shear it properly. It should not be confined by severe pressure or force, or it will be always kicking and struggling. It is the last procedure in the world that should be hurried, as the shearer will often leave more than enough wool on the sheep to pay for his day's wages. The careless and rough shearer often provokes a struggle with the sheep, the animal being forced to the struggle by an effort to free itself from severe pain, or to avoid choking and suffocation. Sheep shear best when full from feeding, and there is then less danger from cutting them, and for that reason it is best that only enough sheep should be penned for half a day's shearing.

After the shearing, the fleece must be properly *packed* or done up. Nothing contributes more to the sale of wool than the neat manner in which it is put up for market, and this is very rarely properly done in Virginia. It is said that in Ohio (the principal wool-growing State in the Union) much attention is paid to this matter, and as the result, the farmers get five or six cents more per pound than do the farmers of New York and other States. The fleece must be laid on a table of good size and three feet high, with the inside down, the tags, burs and dung must be removed; the ends are all to be turned in (the neck and legs), making the two ends in a straight line, then rolled up moderately tight and tied with good twine, and the bundle is prepared. Those wool growers in the Northern and Western States who pay much attention to the packing and appearance of their fleeces have a wool-trough attached to the folding table in which the fleece is put after the bundle is rolled up and tied with twine in two places with much care, the twine being passed through gimlet holes in the trough by some arrangement, but our farmers will hardly go to this expense and trouble for small flocks. The wool after being rolled should be stored in a clean, tight room, and if plastered it will be better protected from rats, and mice, and vermin. When the wool is to be shipped, it should be put in bags or boxes and compressed into a small space as possible, as the railroads charge by bulk, and not by weight. The bag should be strong and of proper size, and it is better to place it under a trap-door in a barn, and while one man hands the bundles, another, with his shoes off, treads them firmly into the bag, and when nearly full, cramming the tags and short wool which have been prepared into the corners and interstices, and it is then to be securely sewed up. The tags are to be prepared for market by washing them with strong, hot, salt water and then in soapsuds, pulling them to pieces and removing the dirt and then rinsing them out in soft water. In this way they can be made into fair marketable wool. The bag should be weighed and marked with weight, quality and name of the raiser. This particularity will pay, making it attractive

to the purchaser and manufacturer, who has to sort all of his wool before using it, and can afford to pay more for it than if it is tangled and tumbled together without proper preparation and without reference to quality.

Should a cold, rainy spell come on soon after shearing, sheep should be put under shelter for the time. Some have practised shearing lambs and their sheep a second time—first of the fall—but it is bad policy in each case, for the wool obtained will not pay the expense and danger of injury to the animals if cold weather comes on, and the lambs will give the same wool when a year old. If rams are re-sheared, it is said to prevent their potency, which should be taken into account, if the farmer thinks of re-shearing in the fall. Dr. Killebrew says, according to a noted Australian author, a flock of 4,000 ewes, with 100 rams newly sheared, produced only 165 lambs, and another writer, with 100 ewes and 4 rams newly sheared, had only nine lambs.

LAMBING.

With the knowledge that ewes "go" five months (or 152 days more accurately), the farmer can so time the coming of his lambs as to suit his plans and views. In Virginia, those who raise early lambs for market desire to have them come in January; but this is usually a bad, cold month, and those who make early lambs a business should be provided with suitable arrangements of every kind to make them and the mother comfortable, and must give the ewes extra feed and attention, and even then, with the weather we sometimes have in January, there must be considerable loss of lambs. It is the custom, in Virginia, of many to permit the ewes and rams to run together all the time, and of course they cannot regulate the fall of the lambs; but this is wrong, and successful sheep husbandry cannot be conducted unless all the necessary means are taken. The ewes and rams should be separated at shearing time and be kept apart until it is wished the ewes to be bred.

The safest time for lambs to drop in our climate is from the 20th January until March 1st, unless the farmer is very well fixed for their coming the first of January, or even in December; but early lambs bear such good prices—\$5 to \$6 in the New York market—that farmers in Tidewater and Middle Virginia, with a mild climate and facility to market, may afford to incur the expense and trouble necessary to raise them. For these early lambs, the rams must be turned to the ewes about 15th to 20th August. Whether lambs come in December or January or February, on cold and rainy days, they must be closely watched and attended to, and they can very generally be saved. After the rams have been let to the ewes, they should be separated and the ewes kept quiet. They should not be kept very fat, as they will not produce such large lambs when too fat; but they must not be kept too poor, as in that condition they cannot produce strong and healthy lambs. Their feed should be increased by degrees just before lambing time approaches, and during all the winter they must be kept from long continued cold, and stormy weather. One pint of grain should be given each ewe daily, until the grass has sufficient growth to keep them in good thriving order. Turnips and other roots, in the opinion of some, should be avoided about lambing time, as they think they are apt to produce abortion. We doubt whether this opinion is correct, and in the Northern States and in England, we think, the use of turnips is not thus restricted. Peavines and the haulm of peanuts are very good for ewes at

this time. Laxative food is necessary before and after lambing, and lambs sometimes die from the ewes becoming feverish and unhealthy from exclusive grain feeding before lambing. We should think a moderate amount of roots at this time would be beneficial, unless there is foundation for the opinion that they produce abortion. At this time green food, such as rye, winter oats, or wheat, two or three times a week before lambing, is very beneficial, and it would be well if some early seeded lots of rye or oats (say seeded in August) were kept for this purpose. We think it is cheaper and better feed for them than roots. If the farmer keeps a record, as he should do, of the time of the ram being turned to the ewe, he will know about what time to expect the lamb, and then the ewe should be separated from the others and kept under shelter at night and in inclement weather. Many lambs are lost for want of this precaution. Everything must be removed around the walls of the shelter, which might catch or hang the lamb, as troughs or racks which might be low enough down for that purpose. If the ewes are separated lambs will rarely be disowned, as is sometimes the case when they are mixed with the flock. Some persons take the precaution to give the lamb a teaspoonful of castor oil to hasten the removal of the glutinous matter of the bowels, and which sometimes accumulates around the vent, stopping it up. The mother's milk in the human is generally sufficient to remove this matter (meconium), and we should think that nature had made the same provision in animals. At least it is well to smear some castor oil or lard around the anus to prevent the agglutination there and stopping the vent. Sometimes lambs have scours, which may be stopped with prepared chalk and paregoric—eight or ten drops, and repeated if necessary. It is well to clip away any wool from around the teats of the ewe which may have been left in tagging. If lambs are disowned by ewes, as is sometimes the case, they must be confined in some way in a frame or hurdle, so that they cannot turn around to butt the lamb. If the ewe kicks, a stick can be run under her and the ends so fixed as to raise her up slightly, so that she cannot kick while the lamb nurses. She will soon get used to this and permit the lamb to suck. She must be so confined every time the lamb wishes to suck until she will permit it to suck willingly.

If the mother dies leaving a lamb, or a twin lamb is too weak to suck, they may be raised by hand without difficulty. Ewe's milk is best, but it being difficult to obtain, cow's milk is generally used, which, by adding to it a small quantity of sugar, closely resembles ewe's milk in taste and properties.

The lamb may be fed as an infant from a bottle with India rubber tube, or a tin oil can with spout may be more durable. The milk should be warmed up to about natural heat—a gill at first and gradually increased. The ewe, while nursing, should be generously fed. As soon as clover and the grasses come in, she should have access to them, and, in addition, oats, meal, bran, corn, and roots, if on hand, mixed with the former; oil meal is an excellent feed for ewes when suckling lambs. Pea straw is a favorite food for ewes, having more nutriment than any other hay, and comes in well to feed with until green clover and the grasses make their appearance. When the lambs begin to feed, they may be given some bran and nice clover cut up and put in a trough, and they will now begin to grow more rapidly than on its dam's milk alone; and to have forward and fat lambs they must be pushed in every way practicable. If not sold to the butcher, and made breeding ewes of, they will make larger sheep and better breeders. If stunted in food, they become dwarfed and never make good thriving sheep; an

animal which has been well fed when young, will have its maturity hastened and will be stronger, healthier, and longer lived than one that has been half fed during its growth, and will make a better breeder. In feeding lambs, it is always best to have a separate "run" for them, with a fixed time to admit them to troughs provided and kept filled with bran, meal, &c., to push them. Some admit them to the cornfields (keeping back the ewes) as soon as the corn is tall enough to prevent the lambs from nibbling off the young ears. They will get the lower shoots or suckers, and the bottom blades of fodder that do not come to anything, without injuring the corn, or probably they will only touch the young grass, if it is growing and tender. Should a ewe lose a lamb, its udder must be attended to, in order to prevent inflammation, by milking occasionally, never taking all the milk and gradually increasing the interval of milking. Bathing with cold water every day will also aid in relieving any inflammation and soreness of the udder. These things must be kept up until it becomes soft and free from soreness.

WEANING.

Lambs not sold to the butcher are usually weaned first of August, but the time of weaning must depend on the age. Four months is about the time usually selected. But if the pasture is good, and it is the object and interest of the farmer to sell his lambs in store condition, they are frequently not weaned until six months old. The lambs and ewes must be separated as far as possible from each other, or at least far enough to prevent their hearing each other's bleating. It is better, two or three days before they are to be parted, to put the ewes and lambs in the field the latter are to occupy, and then in the evening of the day fixed upon the ewes are to be driven away to the pasture they are to occupy. It would be well to milk the ewes two or three times in order to relieve the distended udder and to prevent "garget" or inflammation. The lambs should be put in a good pasture, in order to compensate them for the loss of the mother's milk, but not too luxuriant, as they may be over gorged, and diarrhoea or other disease be brought on. Soon after weaning is a good time to "sort" the lambs and select those intended to breed from, and supply the deficiencies caused by death or barrenness among the ewes. The general health, appetite, growth, form and appearance must be taken into consideration, as also the character of the wool, and the general purposes for which the flock is intended. This is very important in *breeding stock*—not so important where the ewes and lambs are to be sold before the close of the year, but every year there will be some deficiency in the flock, which must be supplied from good lambs.

CASTRATION.

Opinions differ as to the time for castration, some recommending three days after birth, but the lamb is usually weak then, and a better time is when it is ten to fourteen days old. This is a delicate operation, and should be performed by some one skilled in it. Some cut off the end of the scrotum about two-thirds, while others split the scrotum sufficiently to protrude the testicle. One plan probably answers as well as the other if the slit in the latter mode is made sufficiently large for the escape of the blood and pus; if small, it will heal up too soon. But in the first method the wound is longer healing and more pain is caused, and altogether we think the last mode is to be preferred. Formerly it was the practice

for the operator to gnaw off the cord after the testicle was drawn out to prevent bleeding, but a dull knife, by a sawing motion, secures the same object by tearing the artery, and thus preventing bleeding. If the cord is pulled out with a quick but not jerking motion and broken off, this end will be accomplished by probably the best mode. Before this is done, the loose enveloping membrane of the cord must be slid back with the knife. If any of the nerves become exposed, they must be pulled out and cut off. After the operation, put tar and grease in the scrotum and all over it to prevent flies. Castration should be performed when the weather is not unusually warm for the season, and when the animal is well, and about nightfall to secure quiet until the morning. There is usually not much danger in this operation, but sometimes a good many die from it, the same person operating in each case. This probably has been due to the weather, but more probably to some unfavorable condition of the system, produced, perhaps, by over or under feeding. Formerly, castration was practised more than at present, and it is better to sell the buck lambs than to undergo the risk of converting them into wethers, as one year with another some will die with the most careful operations.

Sometimes, when a lamb selected as a breeder does not turn out well, or for some other cause the operation has been delayed, it may be necessary to castrate to fatten him for market. At this time some proceed as they would for castrating the horse with clams and firing irons, while others tie a waxed cord tightly as possible around the scrotum above and clear of the testicles, and usually, in two or three days, the scrotum and testicles will fall off. Great care must be taken that no part of the testicle is included in the ligature, that the cord is not too large so that it cannot be drawn sufficiently tight, and that it is so securely tied that it cannot slacken. If the testicle is included, fatal inflammation will result, and if the cord is not tight enough, sensibility will remain, and much suffering will ensue without securing the result aimed at.

Docking is usually performed for ram lambs at the time of castration, but for ewe lambs it may be done a few days after birth. This consists in cutting off the tail about one and a half inches from the body, to prevent the collection of filth. It is best done on a block with a chisel, drawing the skin of the tail up towards the root, then strike the chisel a smart blow with the mallet, severing the tail at one blow. The retracted skin will now cover the stump, which is to be smeared with tar and lard, to which some add turpentine. Some think docking unnecessary. While the tail affords protection and warmth to the udder of the female, and is a defense against flies in warm weather, it permits the accumulation of much filth, and if the sheep has diarrhœa it becomes a great nuisance, and unless watched the tail may cling to the haunches and afford almost an insuperable obstruction to the passage of the fœces. It should be done just before night, that the lamb may be quiet, and must not be done when the weather is too cold or too hot. It also very much improves the appearance and neatness of the animal.

DISEASES OF LAMBS.

We may as well speak here of the diseases of lambs apart from the general subject of diseases of sheep. One of the most common and fatal is *diarrhœa*, which is generally produced by sudden change from dry to green food or cold or some disagreement of the mother's milk, the first being the most usual cause. In mild cases, dry food with milk may be sufficient, or return to the mother's milk

if just weaned, and the ewe will recognize the lamb. In serious cases, indicated by slow and sluggish step, heavy eyes, and unnatural appearance of the wool, give half ounce of epsom salts in ginger tea, or half drachm of rhubarb, to carry off any offensive matter and offensive secretions which may have accumulated in the bowels, to be followed by an astringent of one-fourth ounce prepared chalk, with six or eight drops of laudanum in half pint of tepid milk twice a day. But if the diarrhœa is severe, and the lamb seems very sick, give one to one and a half teaspoonsful (according to the age and size of the lamb) of the English "sheep cordial," three times a day. This is made up of prepared chalk 1 ounce, powdered catechu $\frac{1}{2}$ ounce, powdered ginger 2 drachms, and powdered opium $\frac{1}{2}$ drachm, mixed in half pint of peppermint water.

Dysentery is different from diarrhœa, being attended with griping and mucus, sometimes blood, and in bad cases with fever. Give a purgative of linseed oil, two to three tablespoonsful, or half ounce epsom salts; and after several free operations are obtained, then give the "sheep cordial," as directed for diarrhœa. If the griping and mucus continue, give the linseed oil or epsom salts again; and after it acts, give again the cordial, three times a day, until the bowels are quieted.

Costiveness.—Lambs suffer from this, and more lambs die from it than is generally supposed. Half ounce doses of epsom salts should be given every six or eight hours, or in mild cases an enema of soapsuds or gruel with two tablespoonsful of castor-oil may be tried first—the quantity (large) being more important than the quality.

Staggers.—Sometimes lambs suffer from staggers, while the old sheep are being afflicted by it; this is generally due to hydatids on the brain, which we will notice more particularly when speaking of diseases of sheep generally.

SELECTION AND USE OF RAMS.

We have said something already of the necessity of the proper selection of rams. When we remember that one ram during his lifetime will get from 800 to 1,000 lambs, and that many of these will perpetuate his good or bad qualities to their numerous offspring, the importance of selecting a good animal is very apparent. A good Merino ram, it is believed, will add more than a pound of wool to the fleece of the dam on every lamb got by it from a common-wooled ewe, and here is one hundred to one hundred and fifty pounds of wool for the use of a ram for a single season; and every lamb subsequently got by him adds a pound to this amount. Besides, every good blooded ram gets from 800 to 1,000 of half blooded sheep worth double their dams, and making the basis of other and higher strides of improvement. A good ram, then, seems as important and valuable as a good stallion. Pure blooded rams should be selected, though some think high-grade rams, as the sixth, seventh, and eighth crosses, will answer as well, particularly the last cross mentioned. No doubt this would be generally true, but the progeny will frequently lack the uniformity, style and perfection of thorough-bred flocks. Pure blood is a fixed standard, and if breeders depart from it in their rams, each one according to his own judgment, the blood of the whole country would become adulterated, for the lambs will occasionally take after some inferior progenitor, and bad points will manifest themselves. Still good flocks have been produced by starting with a high-grade buck; and carefully noting all the different points

of excellence originating in a flock, and preserving only those that possess, in a marked degree, the points to be gained. To this end the best lambs, both rams and ewes, must be selected for breeding purposes. But "in-and-in" breeding must not be carried too far, though it is not necessary to bring a new ram into the fold every year or two, as some farmers do. Should it be the wish to improve the wool, then the selections must be made in reference to its length, quality and fineness, remembering that strength, size, rapidity of growth, and tendency to fatten, whether the flock is kept for wool or mutton, must be controlling considerations. A ram, in consideration of the office he is expected to perform, and the strain upon his system, must have rich, stimulating food in addition to pasturage, when on service, gradually withdrawing the grain after he is separated from the ewes. A ram during service should receive a half pint to a pint of oats a day; and if suffered to run at large, he should be tamed sufficiently to eat from a measure held by an attendant, and careful breeders train them and gentle them from the time they are lambs. Some break them to be led about with the halter, which is a great convenience, and a good way to do this is to fix a cord to an iron ring which has been attached to one of the horns near the point. If rams are not tamed, and gentled to be handled as here indicated, it is a difficult matter to feed them separately. Some breeders, besides the extra food, take the rams from the flocks at night and shut them up in a stall or shelter to themselves, and this is a good practice, for it saves their strength. Rams should not be permitted to run with ewes more than about a month, for it is not well to have lambs come after first of June, and after the rutting season is over the rams frequently grow cross, and injure with their horns the pregnant ewes.

A yearling ram may run with 30 ewes, a two-year old one with 40 to 50, and a three-year old one with 50 to 60. Some very strong, extra-developed ones will serve 70 to 80. But 50 is enough if they *run with* the ewes.

A young ram is not a sure breeder, and an older one is much to be preferred, for the size and strength of the lamb depends much on the strength, size and age of his sire, as well as upon the ewes. A ram at 3 or 4 years is at his prime, and from this age rams get to be uncertain breeders, except Merinos, which last sometimes to 10 years of age.

A good plan to preserve the vigor of the ram, and cause him to serve the greatest number of ewes, and at the same time serve to keep a memorandum of the time the ewes were served, is to have him in a lot to himself, and late in the evening turn in to him 6 to 10 ewes, first having painted his belly with red paint, and in the morning every ewe he has served will be marked with red paint. Keep him separated every day, and turn in again the same number he had the previous evening, until the whole flock, or the proper number, is gone through with. In this way the same ewe will not be served twice, and the farmer, by making a careful memorandum of the dates, will know exactly when to expect the lambs, and thus give the particular ewes the needed extra attention. After the entire flock has been served in this way, and then waiting a day or two, the ram should be put with the ewes for a few days, so that if any ewes should "come in" again he can serve them. Fine blooded ewes should be kept away from the ram until the second year, as earlier breeding interferes with the improvement and growth of the progeny and stunts the ewes.

Several rams should not be suffered to run in the same flock together, for they excite one another to an extraordinary and hurtful activity, besides injuring one

another by fighting. Besides, rams should be selected in reference to the ewes he has to serve, that the points in which they are defective may be made up by his excellence in the same points, or his defects may be made up by the ewe's excellencies; this could not be attained where a half dozen rams were permitted to run with several hundred ewes.

MARKING.

Breeders have many plans of marking. Von Thaër's system, consisting in numbering the sheep by a system of notches standing for numbers, united by a sort of telegram reading, is said to be a good one for large flocks, the numbers being carried up to almost any desired amount. The age is registered by holes through the ears (see Randall, p. 179, to understand the plan). A very good system is to use tags of tin, sold at some of the agricultural stores, that have marked on them the age and number of the sheep and the initials of the owner, the tag being placed in the lobe of the ear as an ear-bob. Both ends may pierce the ear, and then by bending and twisting it is permanently fastened. Others use paint, or lampblack with linseed oil, and then with a brush make any marks desired, either the initials of the owner, or a cross, or a figure. Bucks are generally marked on the rump, wethers on the right shoulder and ewes on the left. Others use Venetian red, which is very cheap. This may be used in the dry state by pinching it up and drawing the fingers with it through the wool, the grease of which unites with the paint and leaves a bright red mark which rain will not efface, and which does not injure the wool, and which is more easily removed by the manufacturer than linseed oil and lampblack. This marking should always be done immediately after shearing, except with lambs, and on the latter after docking.

Dr. Killebrew says: "If there is only a small flock of ewes kept on a place for the purpose of raising fine breeds, it will be found very convenient, yes indispensable, to mark them in such a way as to distinguish them afterwards. The following is a good way to mark them:

22—1878

"The first figure relates to the number of the sheep and the second to the year dropped. This band is inserted in two holes cut in the ear, pushed by each end, and then bent inwards so that it will hold. The ear will soon heal like the holes in a lady's ear, and it will remain for life. The mark should be put up and down on the ewe and across the ear in a buck, so there will be no trouble in distinguishing the sex. It will be a more convenient thing also to have a memorandum book, such as suggested by Mr. Stewart in his work, to tally with the ear-marks, kept in the following manner. Let it be ruled into columns, and entries made accordingly, as per example:

Breed.	Age.	No. of Ewe.	No. of Ram.	When Dropped.	When Served.	Will Lamb.	Lamb.	Remarks.
Cotswold.....	2 yrs.	26	2	Feb 1, 1877	Sep 1, 1879	Feb 1	Feb 2	Twins.

"No one can properly appreciate the convenience of such a book as this until it is tried. By reference to it, anything is known that can be wished about the ewes and rams, and an exhibition of this book will convince the purchaser of the accuracy of any statement made in reference to each sheep in the flock. Under the head of 'Remarks,' any fact in regard to the ewe or ram can be noted, whether she is a good nurse or breeder, and whether the lambs are strong or weak. This book will also enable the farmer to eliminate from his flock all such as are not good breeders, or, if he wishes, he can set aside all ewes that bear single lambs. It will also enable him to set aside such ewes as are becoming too old for the butchers, thus keeping up his flock to the highest standard of excellence."

BREEDING OF SHEEP.

We present the following interesting and practical article from the pen of M J. Wearmouth, Superintendent of the experimental farm, University of Virginia, furnished me some time since for a previous report. He confines himself more particularly to the breeding of sheep, in which he has had much experience :

"Whatever may be the object of the agriculturist in cattle or sheep breeding it is evident that, in the case of the farmer, it resolves itself into a question of dollars and cents. In breeding sheep, however, the same principles which regulate the production and improvement of any other class of animals must in a great measure be acted upon ; and should one person be more successful than another in the production of sheep, that person will be found to have given greater attention to the natural details of the business. The question for the consideration of the farmer is, what kind of animal will ultimately prove the most profitable? This is the all-important interrogatory which he must put to himself. The present or immediate he must sink in the comparatively distant, and whatever may be his disappointment, he must persevere and try again and again, until the arrival of the triumphant day, which is certain to crown his efforts with success.

"It is not my intention to present a long treatise on sheep, but confine myself chiefly to the breeding. The first thing to be considered is the *age*.

"*Age* is commonly counted from the period of their first shearing instead of the time at which they have been born, and may be known, like that of cattle, by the appearance of the fore-teeth of the lower jaw, of which they have also eight—the upper jaw being without any in the front. During the first year they are all small, but when from fourteen to sixteen months' old they renew the first two, and two more every year, until at the fourth shearing, at which time they are—

'full-mouthed.' The period of the first renewal depends, however, in some measure, not only upon the season of lambing, but also upon the goodness of the sheep's keep. Their natural age is generally about nine or ten years, but their teeth begin to fail in the sixth or seventh year, when they become what is called 'broken-mouthed,' and being deprived of the power of easily masticating their food, they fall off in flesh; they, therefore, even when kept for breeding, before that time comes, ought to be slaughtered.

"In breeding, the qualities of both parents must be considered equally, with a view of eradicating the bad as well as perpetuating the good qualities. In breeding animals of a pure kind, the principal rule to be observed is to breed from the very best of both sexes, and cull the faulty ones out every year, saving only the female lambs for the future flock that are as free from defects as possible. The flock must be kept up to its proper size; but every year the finest animals should be selected, until, in the course of time, the flock will entirely consist of them.

"The leading features in a ram or buck are fineness of skin, broad, deep, and round frame. A deep chest, broad at the base, is very essential, for this is indicative of weight. The sheep should walk wide on both legs, keeping them at a distance of at least six inches, parallel to each other. The head should be fine, and rather broad; the eyes full and prominent, exhibiting on the whole an expression of quiet liveliness; the ears small, and the bare parts—the face, ears, and legs—must have a clothing of fine wool.

"*The ewe* should be straight and broad-backed, wide in the loins, and deep-breasted; the angles of her frame will always be sharper than those of the ram, but depth and breadth, with fineness about the throat and legs, ought always to be specially attended to. To secure uniformity in the flock, the ewes ought always to be as much alike as possible, otherwise it will be the next thing to an impossibility to obtain this desirable object.

"Rams and ewes for breeding purposes ought to be put on better keep about the first of September. Climate, and the quantity of spring food provided, must of course, in a great measure, regulate the time when the rams are to be put to the ewes. It is of the utmost importance that the lambs should be dropped as early as possible. It is also advantageous to the ewes that they may arrive at good condition before the commencement of the rutting season; thus a full crop of lambs may be secured. A proper proportion of rams should be employed—say three to one hundred ewes, if they are much scattered, but if they are kept in enclosures two will be sufficient for a hundred. 'A ram, when a shearling or two shears,' will serve sixty or eighty, if proper care be taken. When the active process of gestation has commenced, care should be taken to prevent the ewes getting too fat; if they do, inflammatory disease, absence of milk, and general risk will be the consequences. When the ewes have become large, they should be run about as little as possible; nor should they, in any way, be disturbed, but carefully watched over, and kept away from wet ground, and everything that may be supposed to have an injurious effect upon their health. When very heavy, they are apt to get "cast" and unable to rise, and when this is the case they must be approached with gentleness, and be raised with as much tenderness as can be used. Should a ewe miscarry in very cold or severe weather, she should be brought home, and kept there until she has recovered. In mild weather, however, she will be equally safe in the open air.

"*Lambing.*—About two weeks before the expiration of the period of gestation,

the ewes should be separated from the flock and placed in a grass lot near the house. Smaller lots ought to be at hand, in which the newly-dropt lambs may be separated from the rest and kept free from danger. When lambs are observed to drop on a spot where they cannot easily rise, they should be lifted and placed on their feet; but if everything be favorable, they are better left to themselves. When a week or ten days old, they may be docked; which will be the means of saving a great deal of trouble afterwards. About three inches is a length sufficient for the tail; but males should not be docked until the season for performing the operation of castration has arrived.

“When lambs exhibit no signs of sportiveness, in all probability there is something the matter with them, and they should be examined as well as their dams. By nature they are lively and frisky, full of fun, and much given to play. If, therefore, they exhibit little or no signs of this disposition, it may be taken as a certainty that something is the matter, either with them or their dams. Should a lamb die, it ought to be slowly dragged home, when the ewe will follow it. After she has been brought home, a twin lamb from another ewe may be put to her; and as soon as she has allowed it to suck, they may be both turned out together.

“*Weaning.*—In the weaning of lambs, the ewes should be taken from the lambs, and not the lambs from the ewes. It is best to place the ewes and lambs together in a pasture most suitable for the lambs. The ewes at weaning should be carried out of hearing of their offspring and placed in a poor pasture until the lactiferous system ceases to secrete; and then it is best to send them to a cool upland, if possible. Lambs, however, should be allowed to suck three and a half or four months, after which they may be kept about three weeks at a distance from their dams. Lambs for sale need not be taken off until a purchaser comes and removes them at once. It is a good plan to have a few wethers or barren ewes to put in the field with the lambs after weaning. They teach them to select their food.

“As a rule, the farmers in Virginia are very careless in the management of sheep—giving them little or no attention; the result is a good many die every year from neglect. It would be advisable, then, for sheep farmers to employ a trustworthy person as shepherd, and that person ought to be brought up to his business; he ought to be instructed in all common surgical operations and modes of prevention of disease usually attendant upon the flock. He should be attentively observant of their habits. Although apparently leading an idle life, in merely watching over the flock, yet in lambing and in all seasons of inclement weather he has arduous duties to perform, which must be frequently exercised during the night; the property under his care is also valuable and always demands constant attention. He should be honest, active, careful, and, above all, calm-tempered, for if he at any time gets into a passion with his sheep, he not only occasionally injures them, but acts at great disadvantage both in herding and working amongst them. A good-tempered man and a well-trained dog will effect the desired object with half the time and trouble that is given to the hasty and passionate one. He should be a person in whom the most entire confidence can be placed; he should be furnished with a comfortable cabin, and such other advantages as may render him attached to the interests of his employer, among which perhaps none will be found more conducive than allowing a small percentage on the proceeds of the flock to form a portion of his wages.”

FENCES.

Good fences for sheep are important, for poor fences will teach the grown sheep to jump, and for a jumping flock there is no remedy but a very high fence or getting rid of the flock. One jumper will generally teach the trick to the rest, and if by chance one is brought into the flock he had better be killed or hopped, the former most certain. If they jump the fences and stray off, many are often lost, for there is no limit to their straying, and sometimes whole flocks have thus been lost in rugged, mountainous localities with few settlers. A fold for the night should be provided that is dog-proof, for one or two miserable curs may in a night destroy the work and care of months and years. Almost every one owning a flock or raised on a farm knows by experience the commotion raised by the cry of "the dog's among the sheep," or the indignation and despair produced by beholding some morning the carcasses of dead sheep lying around, and the frightened appearance of the fortunate ones who have escaped, a fright from which they do not recover for months. The fold should be near the dwelling, and a picket fence is best. This may be built of posts let in the ground close together and then stripped with strips 4 inches wide and 1 inch thick, the posts being 8 feet long, two feet of which is let into the ground. Or plank set upright will answer where it is not convenient to get so many posts, only it will not last and be so secure as the posts. Some time since Mr. — Terrel, of Albemarle, originally patented a dog-proof fence, made in the ordinary way, with planks so arranged as to project over on the outside (like a little roof, we suppose,) which would intercept the dog in his attempt to jump over. No doubt it is effectual, but probably an objection to it is the cost. Barns or separate folds may be enclosed with such fences.

The pastures, as we have said, on account of the jumping proclivities of sheep, should be well enclosed.

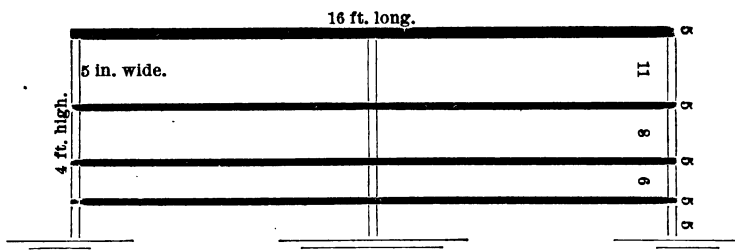
Hurdles are used by some who keep large flocks, and raise large crops of turnips for sheep. They are used not only for feeding off turnips, but also for pastures, where it is wished to graze sheep on particular pastures, as those infested by noxious weeds, so as to clean them off completely, and also for clover, or other kinds of pasturage, as sorghum, rye, &c., that will grow from the stubble after being eaten down; in this way, the clover, &c., is eaten clean, and that in the rear is given time to renew itself, and will be ready for another going-over. For the construction of hurdles, see Dr. Killebrew's "Sheep Husbandry," page 84.

Portable fences are very useful for sheep and other stock. The difficulty is in getting an effective and cheap fence for this purpose. We have seen many; all of them, however, seem to have some objection, but we have the following plan from a practical farmer of one he uses, which he considers effective and economical :

RIVERSIDE, July 20th, 1881.

Dr. THOS. POLLARD :

Dear Sir—The fence is made of stuff 5 inches wide and 1 inch thick, 16 feet long. You take the knotty pieces, and cut 4 feet long, and sharpen at the lower end; the boards are put 6, 8 and 11 inches apart, leaving 5 inches below the bottom rail. Two wrought nails, 2½ inches long, are nailed in each strip or post, and clinched. You can crook this fence (as a worm fence), 6 feet from a straight line, and fasten the upper corners together with a piece of No. 12 wire, and it will



stand a hard wind. But I prefer a straight fence; so I use a small split post, sharpened at one end, $4\frac{1}{2}$ feet long, and driven in the ground one foot—then a piece of No. 12 wire around the post and two ends of fence near the top of post will keep it up against very hard winds. Lap the two ends 5 inches on each other at the post—thus,



I like this fence very much, and have used it three years, keeping sheep, hogs, cattle, horses and mules in a pasture with it. You can move and put it up very quickly, using a wagon and team to haul it.

Very truly, yours,

F. GUY.

Chesterfield county.

SHEPHERDS AND SHEPHERD DOGS.

Large flocks of sheep require shepherds, and even moderate flocks are much more certain of proper care and protection if one man is regularly assigned to their custody. Shepherd dogs have not been much used in this country, but are coming more into use. These dogs, of different varieties, are used in Spain, France, Hungary, England, Scotland, Mexico, and South America. These varieties differ in size, fierceness, and other characteristics. The Spanish, Hungarian, Mexican, and some of those of France are large dogs, some as large as the Newfoundland dog. Most of them probably came from the Spanish breed, which are large and very fierce, as is the Hungarian dog. The English shepherd dog, or drover's, or butcher's dog, for by all these names he is known, is considerably smaller than those just mentioned, but larger and stronger than the Scotch colley. For some reason the latter has been most imported and used in our country, and is getting quite common in the Northern States. These dogs, if properly trained, no doubt are very useful; if not properly trained, and the sheep made accustomed to them, they have been known to kill and worry the sheep they were expected to protect. Mr. Skinner relates a ludicrous instance illustrating this fact, and the fact of the importance of the sheep being taught to regard this dog as his friend and protector, instead of the hereditary enemy which their instinct teaches them to fly from. A thoroughly broken sheep dog had been sent from abroad to Mr. Jefferson, at Monticello. After having held forth to some visitors in glowing terms the value of these dogs, and their great convenience, and their indispensability in managing flocks, the sage of Monticello led forth his guests to give practical exemplification of the qualities of his dog. [At the word the latter

made for the sheep, and the frightened animals fled in all directions, some of them dashing themselves over precipices and breaking their necks. The dog, mortified at his failure, felt his pride too deeply wounded to return, and Mr. Jefferson never recovered him. (Dr. Randall.)

The most effectual way to bread a shepherd dog is to have the puppy accompany the flock master whenever he goes about his sheep, several times a day. The puppy will soon get accustomed to them, and they to him, and the flock master can soon make him drive a flock in any direction, as these dogs have a natural instinct to drive stock, as natural as following up and hunting birds is to the pointer, or following up rabbits, to the hound. The general belief is that the Mexican shepherd dog descended from the Spanish shepherd dog, but Dr. Killebrew says "they (Mexicans) select the young pups from some large breed of the common cur dog, and put them to sucking a ewe, first taking away her own lamb. At first she will rebel against the substitute, but from the desire to be relieved from her milk will permit them to suck her, and finally regards them with the same affection that she would her offspring. For the first few days they are allowed to suck only twice a day, morning and evening, but after she becomes accustomed to them, they may be allowed to run together in a small enclosure. Finally, they are turned in with the whole flock, that they may get accustomed to them also, for no sheep will take to a strange dog at first, not even the finest bred shepherd dogs. After the pups are weaned they will never leave the particular flock they were raised among. No other dogs dare approach the flock, and not even a strange person. If a pack of wolves come around the flock at night, the dogs keep up a continual barking, which frightens them, so that a sheep is seldom destroyed by wolves. Three or four dogs are kept with a flock of 800 or 1,000 sheep. These dogs are much fiercer and stronger than the Scotch Colley, and can be trained to the care and management with equal skill and fidelity, while the cost is nothing but the time and trouble rearing them; they will not require to be fed meat, as corn dodgers and milk are quite sufficient for them." This system would probably be a good one for our mountain regions in Virginia, which are infested with wolves. These large dogs are necessary in Mexico from the fact that the prairie wolf there is more to be dreaded than dogs. But we are disposed to think that these "common cur dogs" referred to by Dr. Killebrew are really the descendants of the old "Spanish shepherd" dog.

Mr. J. H. Lyman, in the 3rd volume "American Agriculturist," as quoted by Dr. Randall, says: "Although Mr. Kendall and others have described this wonderful dog as a cross of the Newfoundland dog, such I think cannot be the fact; on the contrary, I have no doubt he is a genuine descendant of the Alpine mastiff, or more properly Spanish shepherd dog, introduced by the Spanish at the time of the Conquest. He is only to be found in the sheep-raising districts of New Mexico." After saying that the other Mexican dogs, which number more than one thousand to one of these noble animals, are crosses of everything having any affinity to the canine race, including wolves, mountain cats, lynxes, &c., he says: "That country would be the plague spot of this beautiful world were it not for the redeeming character of the truly noble shepherd dog, endowed as it is with almost human intellect." He then describes the mode of education and bringing up of these shepherd dogs, which is the same as that described by Dr. Killebrew, quoted above, in reference to the common breed. Mr. Lyman then relates an instance of a flock being left by the shepherd, who having great confidence in his

dog, went to visit his native village, but forgetting to provide for his dog in his absence, found on his return that he had been slowly driving his flock *towards the village*, but himself so much exhausted by starvation and constant watching as to be dying. The starving dog could have helped himself to one of his *little brother lambs*, or could have deserted the sheep and very soon have reached the settlements, where there was food for him, but faithful even unto his death, he would neither leave nor molest them, but followed the promptings of his instinct to lead them into the settlement; their unconsciousness of his wants and their slow motions in travelling were too much for his exhausted strength. . . . Many anecdotes could be related of the wonderful instinct of these dogs. I very much doubt whether there are shepherd dogs in any other part of the world except Spain equal to those of New Mexico in value. The famed Scotch and English dogs sink into insignificance by the side of them. Their superiority may be due to the superior mode of rearing them, but they are certainly very noble, naturally of large size, and highly deserving to be introduced into the United States. A pair of them will easily kill a wolf, and flocks under their care need not fear any common enemy to be found in our country.

It is rather surprising that they have not been introduced into the United States, and particularly into the mountain regions of our own State, West Virginia, and other mountainous districts, where wolves occasionally destroy flocks of sheep. They are better protectors too against the cur dogs which attack our sheep than the English and Scotch dogs, which are too small for that purpose. The English and Scotch dogs we saw at our last State Fair and at the International Exhibition of Sheep in Philadelphia did not seem well trained, and did not make a very favorable impression, but this may have been due in part to the crowds which surrounded them and the unaccustomed position in which they found themselves.

As a proof of the efficiency of these Spanish dogs, Mr. Kendall says he met on the "Grand prairie (Mexico) a flock numbering 17,000, which immense herd was guarded by a very few men assisted by a large number of noble dogs, who appeared gifted with the faculty of keeping them together. There was no running about, no barking, or biting in their system of tactics; on the contrary, they were continually walking up and down like faithful sentinels on the outer side of the flock, and should any sheep chance to stray from its fellows the dog on duty at that particular post would walk gently up, take him carefully by the ear, and lead him back to the flock. Not the least fear did the sheep manifest at the approach of these dogs, and there was no occasion for it." The large shepherd dogs are found in South America, no doubt descendants of the Spanish breed. In France, they have some large dogs, if not descendants of the Spanish, are pronounced equal to them. In almost every country where fine woolled sheep are bred, but our own, are found these large, powerful dogs, and it is singular that they have not been introduced here. *

OBSTACLES TO SHEEP RAISING.

The only causes militating against sheep raising in Virginia that we know of are their destruction by dogs and wolves. The latter do but little damage, but the former are a serious detriment to this interest. Besides the number of sheep destroyed by them, the fear the farmer entertains of the probable destruction of his flocks deters many from embarking in the business and others from keeping

sheep except in a very small way. Then the effects upon flocks which have been attacked by dogs is very deleterious. For months they do not get over their fright, and perhaps never, and whenever they see a dog their fright is renewed, and they run in every direction. The writer well remembers a flock of sheep on his paternal farm which were periodically attacked by a pack of fox hounds, and how timid and demoralized the survivors became. The flock did not thrive, and their increase was small compared with what it would have been. Still the flock was kept, and still the hounds would make their yearly or more frequent incursions. The injurious effects of this fright upon sheep are manifested when they are being fattened for market. They then require the utmost quiet and repose, and the whole flock should be made so quiet that each sheep will take food from the attendant's hand, for no animal is more easily gentled and none thrive more by it than sheep. Now, permit them to be chased and frightened by dogs and the improvement ceases. They will, under these circumstances, actually suffer from hunger when the troughs are full. A correspondent has lately stated to me that his flock of sheep never did well after having been once severely depredated upon by dogs.

We have no means of determining the number of sheep killed by dogs in Virginia. In 1878 I sent out a circular to find out the condition of crops, stock and labor. Among other inquiries was one relating to the number of sheep killed in the counties by dogs. Of course the number could only be approximated, or guessed at, but in many counties and neighborhoods there were reports of sheep being killed by dogs.* The evil is certainly a great one, and if legislation to abate it cannot be obtained, the farmers must take the matter in hand and use more active and siringent measures to protect their sheep. The Legislature of Tennessee in 1875 enact a "Dog Law," which was repealed by the Legislature of 1876, we suppose, in consequence of a decision of the Supreme Court of the State that it was unconstitutional—that dogs were property, and must be taxed like other property. That difficulty would not exist in Virginia, as here they are not deemed property (by our Constitution). During the short time the law was in operation the decrease of dogs was 32,187 (Dr. Killebrew). It has been found that the number of sheep killed is, as might be expected, in proportion to the number of dogs existing. "There are nine dogs in Tennessee to one in Ohio. In Ohio there is one dog to every twenty-seven people, and as for sheep there are forty-six sheep in that State to one dog. The Ohio farmers annually receive over twelve million dollars for their wool and mutton. . . . On account of the strangely delusive dog detriment, of which 'The South' has so often complained, indefinite millions of dollars are annually lost to the Southern country. On account of the enforced neglect or abandonment of sheep culture, to say nothing of the dangers and death from the most hideous madness (hydrophobia), all endured out of deference to the dogs. What men!" (Dr. Killebrew, from the "New York South.")

Dr. Killebrew further quotes from an article on this subject by J. W. F. Foster, LL. D., of Tennessee, who, in speaking of the array of charges that could be made and sustained against dogs, says: "It would be proved that the food consumed by each dog would produce one hundred and fifty pounds of pork, which would aggregate nine millions of pounds, worth, at the lowest estimate, five hundred and forty thousand dollars. It would be shown that in consequence of their evil disposition

* The reports were from seventy-six counties. All did not report sheep killed. One county reported as many as twenty per cent. killed.

(the dogs), our farmers are deterred from engaging in the raising of sheep, by which a loss of revenue is caused to the people and to the State of at least five millions of dollars annually. It would be shown that the destruction by them of property annually averages but little less than that produced by fire and flood. It would be shown that a large number of immigrants with money in their purses and brains in their heads, are prevented from settling among us, and helping to build up the country, from the fact that these dogs render it too hazardous to embark in the only agricultural operation that offers a reasonable prospect of profit. It is a crime against the dignity and welfare of the State that such a nuisance exists."

THE REMEDIES FOR KILLING SHEEP BY DOGS.

The first redress is by legislation in conjunction with personal effort, the second by personal effort alone, where legislation cannot be obtained. Our Legislatures should at least, it appears to us, give the counties local option in regard to dog laws. Let the people decide whether they will accept the provisions of such acts framed by the Legislature. Some counties have thus obtained dog laws, with which they are well contented, and which are acting well. Altogether, we have reason to believe that with the aid of these laws and with the increased use of precautionary measures, the number of sheep killed by dogs is diminishing. We find by reference to Acts Assembly that dog laws have been enacted for the counties of Augusta, Albemarle, Bedford, Botetourt, Clarke, Charlotte, Culpeper, Fauquier, Fairfax, Frederick, Montgomery, Powhatan, Rockingham, Shenandoah, and Wythe. From Shenandoah we have the following from a correspondent, Mr. John H. Grabill: "For the year ending November, 1880, the damage to sheep by dogs was \$691.80. For the same year there was paid out of the dog-tax fund for 400 fox scalps, \$293.45."

In Bedford county the tax on dogs has more than paid for the damage done by them on sheep, besides for scalps on wolves and foxes. In Albemarle the act has never been submitted to a vote, for fear, we suppose, that the sovereign dog owners would reject it, and probably this is the case in other counties.

In ——— county, the county superintendent writes: "We have a dog law, but persons who lost sheep four years ago have not yet been paid for them. The annual loss from dogs is on an average \$150." (County not named, and post-office mark indistinct.)

Acts existed for Lee and Rockbridge, but they have been repealed. These acts are very similar in their main provisions. The funds raised by taxation on dogs are appropriated to the payment for sheep lost by dogs, and the balance, if any, is appropriated to the support of the common schools, or turned into the county treasury. In some of the counties that we know of the fund raised has been more than sufficient to pay for sheep lost, and in most of them, we believe, it has been sufficient. The tax varies from 50 cents to \$1 on male dogs, and from \$1 to \$3 on female dogs. In Clarke county the tax is 75 cents on each dog; this goes to pay for sheep killed, and the balance, if any, goes to the school fund. We will say here that we think the tax should be much higher on females dogs—say \$4 or \$5—than on males. If that was done few females would be raised, and the number of dogs would be much diminished. And we will further say that we consider these laws most proper and necessary. If dogs inflict these injuries on farmers, their owners should be made to pay the damages. And really there is very little

hardship in the action of the laws on this subject, and in many instances it is a direct benefit to the owners of dogs, relieving them of the support of useless animals, which is no inconsiderable expense; much more than the tax of a dollar or two imposed by law. Many persons keep surplus dogs, which they must know they have no use for, but seem to keep them around them almost without reflection. A tax on their dogs would arouse them from their reverie, and induce them to get rid of all that were not useful and necessary. Each dog's feed would support and raise a good hog for the poor man, which when Christmas comes would be something more tangible and useful than a worthless cur, whose keep for another twelve months would support another hog. Sheep, which the dogs destroy, furnish the best clothing and meat for the human family, while the carcass and hair of the dog are good for nothing, and worse than nothing in view of the expense and trouble they cause. Then the danger from hydrophobia, from the useless dogs that roam the country, should be taken into account. Better destroy all dogs that are not really useful and necessary than that one valuable human life should be sacrificed to hydrophobia. Some dogs are necessary and valuable. It is against the useless, surplus ones we protest. The good ones are friends to mankind, the most faithful and affectionate of animals, and no wonder the affection is warmly reciprocated by many, and even in some instances carried to an extreme of devotion. It was this feeling which prompted Sir Walter Scott to erect over his favorite Maida, near the entrance door of Abbotsford, a marble monument and image with the inscription on one side, "*Maidal marmorae dormis sub imagine, Maida!*" (Oh, Maida! you sleep under the image of the marble Maida), and on the other, "*Domini, sit terra tibi levis*" (May the earth of your master rest lightly on you); and the same feeling which, when in some legislative hall, it was proposed to tax dogs, impelled John Randolph to exclaim, "Why tax dogs? Tax men! Dogs are faithful; men are faithless." Randolph's fondness for dogs was as great as was his dislike for sheep, a dislike alluded to in the previous pages of this treatise; but something different from affection for dogs induces many persons to keep them, particularly our colored citizens; it seems to be a habit and foolish custom, followed by some, as we have said, almost without thought. Another thing contributes to their numbers; they are born on the place, and persons dislike to kill them, particularly as the little pups look so interesting and innocent, and they are permitted to grow up and swell the throng. A good tax on bitches would soon show a great diminution of dogs. Some of the acts alluded to above permit one dog to be kept without tax, a provision no doubt which makes the law less objected to. It would, we think, be a good proviso that this dog should be a male.

There are various means in the hands of sheep breeders of preventing their sheep being killed by dogs, when legislation fails to give the desired protection. Sheep should be folded near the house of the farmer, in an enclosure as near dog proof as practicable. The picket fence mentioned will generally answer, or the one patented by Mr. Terrell, of Charlottesville, might be inquired about. Dogs raised with sheep and kept with them are a protection, and it gets the sheep accustomed to dogs and prevents their running when they see a dog approaching, a thing which frequently causes dogs, particularly young ones, to pursue the sheep. Dogs may be reared with sheep by permitting puppies to suck ewes which may have lost their lambs, or which may be removed for the purpose by putting the lamb with another ewe having a lamb of the same age—a plan above men-

tioned as pursued by the Mexicans in rearing their shepherd dogs. It is said if cows with young calves are kept in the pasture with sheep and a dog approaches, the cows put at him followed by the bull and the steers, and a fierce onset drives the dog from the field. A shot-gun is a very effective implement to protect a flock of sheep with by day, and strychnine comes into play at night. Dr. Killebrew quotes Mr. Cockerill, who has a large flock of sheep within three or four miles of Nashville, as saying that he never lost any sheep by dogs—that he always kept a shot-gun ready, and whenever a dog came around his premises he killed him. His neighbors who had dogs understood this, and kept them at home, and the dogs generally learned themselves to keep away, fearing, we suppose, the fate of their companions. A gentleman in one of the lower counties of Virginia writes me that he never loses his sheep by dogs, taking the precaution of throwing some meat with strychnine on it around his sheep fold at night. Bells around the neck of sheep are said to be a considerable protection against dogs, the noise of the bell either frightening the dogs or warning the hands on the farm. Another precaution is for the attendant of the sheep to have his sleeping quarters near the sheep fold.

POISONOUS SHRUBS.

Most farmers know that Laurel, commonly called Ivy, but improperly so, is poisonous to sheep. It seems that the Mountain Laurel (*Kalmia Latifolia*) and the Small Leafed Laurel, Ivy as it is called (*Kalmia Angustifolia*), are both poisonous to sheep, and inexperienced sheep raisers should be on the look out for it, for a large number of sheep are sometimes poisoned by it. It has been said that the Ground Ivy, Pipsissewa as it is called (*Chimaphilla Umbellata*), has poisoned sheep, but we scarcely think this is so, because it is used in medicine without particular care as to the dose, and never has been thought to possess any poisonous quality. It is probable that the Swamp Laurel (*Kalmia Glauca*) is poisonous to sheep, as it possesses properties very similar to Mountain or Broad-leaf Laurel, and Ivy so-called, or Narrow-leaf Laurel. The leaves of the Swamp Laurel rarely reach near the ground, and on that account it is not much accessible to sheep. Strange to say, the Laurels are eaten with impunity, it is said, by Goats, Deer and Partridges.

DISEASES OF SHEEP.

We shall endeavor to make what we have to say on this subject as practical as practicable, as much that has been written of diseases of animals is useless, and much, worse than useless. I have not much confidence in veterinary science in this country, and if Youatt, who, we believe, was a "Veterinary Doctor," is an exemplar of English veterinary practice, we are not encouraged to think highly of it in that country. We have examined what Youatt has to say on diseases of sheep in his work on sheep, published in this country in 1857, more than half of the volume being devoted to their diseases, and have arrived at the conclusion that the breeders of sheep would be as well off without it, and better perhaps. For a great many of their diseases he advises bleeding—diseases in which physicians would not think of using it in the human. The writer having been a practitioner of medicine at one time, and for a number of years, believes it gives him some insight into the proper treatment of diseases of animals. While the anatomy and diseases of different animals vary in most points, there is strong resemblance and

analogy, and there are certain general principles pervading the medical treatment of all animals. Many of the diseases of men and animals are very similar, and require like treatment. For instance, Colic, Tetanus (Lock-Jaw), Diarrhœa, Dysentery, Apoplexy, Phrenitis (inflammation of the Brain), are relieved by the same remedies in each, and in a measure Pneumonia and some other diseases require a like treatment. Youatt has a long list of sheep diseases, many of them ill-defined with many irrational remedies recommended. He says Tetanus and Epilepsy are kindred diseases in all animals, and in none do they so closely assimilate as in the sheep. Now, the causes, the symptoms, and the treatment are all unlike in the human, and we suppose also in sheep, and we doubt whether sheep have Epilepsy at all. He describes Palsy as being produced in young lambs by cold. Now, the Palsy thus described is nothing but want of use of the limbs from cold and debility, as his statement shows, as well as the treatment recommended, viz., warmth and gruel and ale. He says: "Apoplexy is a sudden and fatal oppression of every organ of the body, not produced by more violent determination of the blood to the head than to other parts." This determination of the blood to the head is exactly what constitutes Apoplexy, unless it is a very different thing in the sheep from what it is in the human, and we have no idea that it is. These examples suffice to show Youatt's mistakes in pathology, or what the conditions, or status, or causes of suffering are in the different diseases. As to the treatment advised by him, we believe it is entirely too lowering and depressing, bleeding, as before remarked, being a prominent remedy with him. We have been led to believe that sheep require and will bear less depressing treatment than almost any other animal. Most persons have observed that if sheep are sick much, they are very apt to die, and that quickly. They do not seem to be constituted as to resist disease like some other animals, and no doubt animals differ in this respect. We all remember the proverb of the cats having "nine lives," and dogs seem almost as hardy. Horses, cows, goats and hogs seem all to have more resistance than sheep. We only know of two diseases—Pleuro-Pneumonia and Hog Cholera—that are usually fatal to cows and hogs. Distemper is occasionally fatal to cows. Youatt advises bleeding in all the diseases of sheep considered inflammatory, including Pneumonia, a disease in which bleeding in the human is rarely practiced now, but also in diseases not inflammatory, as Tetanus, and we presume Epilepsy, as he considers them kindred diseases, Dysentery, Rot (disease of the Liver), &c.; the two latter, if inflammatory, are of low and peculiar type, and in which we should not think of blood letting. He says after bleeding in Dysentery "give two doses of physic," but without saying what kind of physic.

Youatt advises the sale of sheep to the butcher when they are found to have Rot. Rot favors for a short time the accumulation of fat. Dr. Randall, in his work, already frequently quoted from, says: "It is with pain I make the following quotation from Youatt—the only thing of such a character as I have noticed in his voluminous works." He then proceeds to give the quotation, part of which we give: "It has already been stated that the meat of the rotted sheep is *not like that of the sound one*. It is pale and not so firm; but it is not unwholesome! and it is coveted by certain epicures, who perhaps are *not altogether aware of the real state of the animal!!* All this is a *matter of calculation*, and must be left to the owner of the sheep; except that if the breed is not of very considerable value, and the disease has not proceeded to emaciation, or fearful symptoms, the first loss will probably be the least; and if the owner can get anything like a tolerable price for

them, the sooner they are sent to the butcher or consumed at home the better. Supposing, however, that their appearance is *beginning to tell tales about them*, and they are too far gone to be disposed of in the market, or consumed at home, are they to be abandoned to their fate? No; far from it." (Italics Dr. Randall's.)

Dr. Randall says: "Conceding to Mr. Youatt the whole benefit of that saving clause about 'consumption at home,' the above sentence is one which I could well wish was stricken from his valuable work. The sale of the meat of diseased animals for human consumption is abhorrent to decency and propriety, and there is not a respectable American family which would not revolt at the idea of either selling or consuming such meat." But Dr. Randall is mistaken in supposing this is the only thing of this kind that Mr. Youatt has advised. He advises that sheep with Hydatids be killed and sent to the butcher. He says, "Send him to the butcher in whatever condition he may be. The chances are that he will eventually die, and die worthless, a mere skeleton; at present he will probably fetch some price, and the wholesomeness of the flesh has not been impaired in the slightest degree by this disease in its earlier stages." It is hard to believe that such an animal has his blood and the tissues which are nourished from it in a healthy condition, and fit for food. Again, speaking of "Consumption" in sheep, Youatt says: "With regard to the common run of sheep, when wasting has commenced and is accompanied by cough or Dysentery, the most honest and profitable advice which the surgeon could give to the farmer would be to send the animal to the butcher while the carcass will readily sell." It cannot be pretended that a sheep with consumption is fit for human food, and this advice is surprising; astounding!

In view of all this, Dr. Randall says:

"I have examined all, I believe, of the most celebrated late English authors, scientific and empirical,* on the diseases of the sheep and their cures. For anatomical and general pathological details, the works of some of the former possess great value, and compare favorably with the treatises on the same topics by the most eminent physicians and surgeons. This is particularly true of the work on Sheep by the late Mr. Youatt—the fountain-head from which most of the later English writers on the same subject have so liberally drawn, and will probably continue so to do for a century to come. For minute accuracy of description, particularly in the department of pathology—for elaborate research into both facts and authorities—for clearness and sparkling vivacity of style, this gentleman, it seems to me, is entirely without a competitor among the English veterinarians, and his works will bear reading alongside those of a Cooper, a Louis and a Chapman."

This too, coming from Dr. Randall is surprising!

We think there is little necessity or propriety in any treatise on the anatomy of the sheep accompanying a popular work on sheep husbandry. Very few would read it, and if they did, very few would profit by it. Dr. Randall says he has been led to doubt whether *any systematic* treatise on anatomy (such as that given by Youatt preceding diseases of sheep) is necessary. Still he devotes seven large

* I do not use the word "empirical" here in its invidious sense. I mean to describe by it a class of writers *versed in experiments merely*, as contradistinguished from those who possess a scientific knowledge of physiology, pathology, therapeutics, &c.

pages to the anatomy of the sheep. Dr. Randall seems to follow Youatt in the treatment of diseases of sheep, and frequently quotes from him on this subject. He advises bleeding, as does Youatt, in dysentery, pneumonia, and apoplexy, which he calls a *nervous* disease. Medical men never bleed the human for nervous diseases, but it may be as well to say apoplexy is not a nervous disease. Medical men bleed in apoplexy, sometimes, though rarely now, in pneumonia, and we may say almost never in dysentery. Strange to say, Dr. Randall enumerates phrenitis, epilepsy, tetanus, palsy and rabies together, and says of the treatment, "Warmth, gentle stimulants, and good nursing, might raise the patient, but in nineteen cases out of twenty it would be more economical, and equally humane, to at once deprive it of life." Now, what is the use of this parade of anatomy of the sheep and not inform his readers that phrenitis is *inflammation* of the brain, and that if any disease generally requires bleeding it is this, and not "gentle stimulants"—that rabies is hydrophobia, which of course should not be subjected to treatment, but the animal should at once be killed? The diseases of course should not be classed together. Youatt, as might be supposed, advises bleeding in phrenitis, which no doubt is frequently proper.

Dr. Killebrew, out of 207 pages on the sheep, (excluding an article on Angora goats, and some appendix,) devotes 12 pages to diseases. He does not mention bleeding once, but his list of diseases is very incomplete, omitting pneumonia, apoplexy, phrenitis, &c., diseases in which bleeding is more frequently used.

Spooner, an English author, in his work published in 1844, and which is of considerable merit, out of 456 pages devotes 87 to diseases of sheep, besides 75 to anatomy, is much less in favor of depleting treatment than Youatt, and makes some very sensible remarks on the pathology and constitution of the sheep, showing why they will not bear well a lowering treatment. He says the sheep possesses a smaller portion of blood than other animals—not more than four or five pounds—that the nervous system is feeble and the muscular development is weak, and that they cannot take laborious exercise, even in a state of nature—that their diseases are nearly all of a debilitating character, diseases distinguished by want of tone, and that the animal quickly sinks under the attacks of morbid agents. If this is true, and we do not doubt it is, it is easy to determine whether Youatt's treatment of diseases of sheep has done more of harm or good in the world.

Spooner further remarks that the brain of the sheep is small, and the intellect weak; that the digestive apparatus consists of a variety of complex parts, and that most of the diseases of sheep fall on these parts; and that most of such diseases arise from an abundance or deficiency of food—either too dry, or too moist, too young and luxuriant, or too old and withered, containing unwholesome or poisonous food, or invisible eggs of insects. These diseases of digestion can rarely require any blood-letting.

Little, who was a shepherd, (Eding. 1815,) wrote on the mountain sheep farms of Scotland. His book consists of 150 pages, and contains only four pages on diseases of sheep. He professes to know little of these diseases, and we might come to the same conclusion when we find he advises bleeding in October as a *preventive* of disease. Strangely enough, he devotes 15 pages to the advantages of *railways* to the farmers of Scotland; and this in 1815. And strangely, too, does not tell us what these railways were, or how constructed; perhaps they were plank or "corduroy" roads.

The Library of Useful Knowledge, London, 1837, contains a work on Sheep

Husbandry, pp. 560, of which 132 are devoted to the "Anatomy and Diseases of Sheep." But this is by Youatt, and is only a larger edition of Youatt on Sheep, published in 1851, and on which we have been commenting.

From what has been said on these authors' views of the treatment of diseases of sheep, my views of the general treatment of sheep may be inferred. We may remark here that among the objections to the treatment of these diseases in England is that their modes are often too expensive and troublesome to be generally adopted here. Directions for the treatment of diseases in this country to be popular must be simple and easily carried out. Another objection is that their diseases vary from ours on account of climate and surrounding circumstances. Many of these diseases, no doubt, are similar in character, but they have some destructive diseases which are little known here; for instance Rot, due mostly to wet, which Youatt says annually sweeps off a million of sheep in the British isles. When the disease exists here, it is in modified form, little extensive, and not much contagious or epidemic. Col. Ro. Beverley, of Fauquier, informs me that it prevailed in his section soon after the war.

We shall proceed to speak of individual diseases.

PNEUMONIA AND PLEURISY.

These diseases are rare in this country, and particularly in the South. When the sheep has hard cough with fever, shown by heat of skin, rapid action of the heart, and rapid breathing, and heaving of the flanks, the disease may be suspected. With these symptoms, the sheep is dull, the eye is clouded, it ceases to ruminate, the nose discharges a tenacious, sometimes offensive, matter; it drinks freely, and sometimes expresses pain by grinding its teeth, which pain is produced by accompanying Pleurisy, Pneumonia itself rarely producing pain. Before death the pulse or action of the heart weakens and the surface gets cool. These of course are unfavorable symptoms. After death one or both lungs are generally hepatized, that is, the lung has become solid like the liver (*hepar*, liver) and incapable of admitting air. Mr. Youatt says this shows the lung has become gangrenous, and that inflammation of the lungs generally takes on this gangrenous character—an argument against bleeding. But this is not *gangrene*; it is *hepatization*. The lung in this state is easily broken down. If there has been complication of Pleurisy, the lungs are found adhering to the side of the chest, the consequence of the inflammation and effusion of lymph.

Treatment.—I should not bleed unless in the early stages and the sheep was strong, young, and in high health, and with high grade of fever, being probably the result of Pleurisy complication, believing it best almost always to attempt to reduce these symptoms with purgatives and low diet for a few days. First, give Epsom salts 2 ounces, and repeat this in smaller doses sufficient to keep the bowels well open. Give access to water, and feed lightly, though the animal does not have much disposition to eat. Spooner, in addition to the purgative, recommends Nitrate Potash (Saltpetre) 1 drachm, Digitalis, powdered, 1 scruple, Tartarized Antimony 1 scruple. He does not say how often. He must have intended this to be given frequently in divided doses, as it would be a dangerous dose; we give to the human only fractions of the grain of the two last medicines. In addition to this, I should remove the wool from the chest, and apply *Blistering* salve, by warming it, and rubbing it in the skin. I would apply the Blister over the diseased

lung if I could discover that by listening to the breathing, and if not, would apply it over both lungs. Sometimes both lungs are diseased. Where Pleurisy exists with the Pneumonia, pain and high fever occur, and these are about the only cases requiring bleeding.

BRONCHITIS AND CATARRH.

Both these arise from cold. Bronchitis is inflammation of the lining membrane of the Bronchial tubes, which convey air to the lungs, and more or less of it generally exists with Pneumonia. It is attended with cough, wheezing, and fever. Ordinary Catarrh is attended with cough, running from the nose, &c., with little or no fever. Bronchitis, if attended with decided fever, is best treated with purgative doses of Epsom salts, and if in winter the sheep should be put under shelter. Catarrh requires no treatment but proper sheltering. Both the diseases may best be treated by *prevention*, if such a phrase is allowable. Good comfortable, *well-ventilated* shelters should be constantly accessible to sheep in winter, and with this, if good food is provided, they will rarely contract cold.*

MALIGNANT EPIDEMIC CATARRH.

Catarrh in Epidemic form (Epizooty) occasionally attacks sheep, as well as horses, and the human, and in some instances has swept over the Northern States with great mortality; it rarely appears in the South. The fact that this disease is so much more fatal to sheep than to horses is another evidence of the less resistance of sheep to disease. It usually occurs in winters attended by sudden and violent changes of weather, and attacks the delicate breeds more than the hardier. During the past winter a good many sheep perished in the North and West by cold, and some in the colder parts of Virginia. We have not heard that this was the effect of this epidemic disease, and suppose it was due to the depressing effect of cold, with insufficient shelters, producing, no doubt, in some cases, Pneumonia and Pleurisy and Bronchitis. But in severe winters, the sheds are sometimes kept too close, without sufficient ventilation, and it is believed that this has produced the disease in some instances. Dr. Randall gives an account of an epidemic occurring on his farm (in New York), which he thought was produced by his manager, in his absence, shutting up his sheep closely in a severe spell of cold weather, thus producing foul air, and which was very fatal; very few of the cases attacked recovering. There was one flock of one hundred sheep shut up in a sheep-house, both doors being closed, whereas he had always left one open. He found the air very foul on his return, and disease commencing in the sheep. There was no cough, but running at the nose. Many died, and none recovered after the emaciation and debility had proceeded to any great extent. In "post mortem" examinations, he found the seat of the disease was *inflammation of the mucous lining of the whole nasal cavity*, which was highly congested and thickened throughout its whole extent, and sometimes ulcerated; the inflammation extending also to the mucous membrane of the Pharynx and upper portion of the Aesophagus (the tube conveying food to the stomach). The treatment he used was blowing Scotch snuff up the nostrils, to clear them of accumulated mucus, and produce free and unobstructed discharge, and thus remove congestion of the membrane, and one-eighth

* Yrueat says Bronchitis is caused or accompanied by *worms* in the air passages, and that the remedy is $1\frac{1}{2}$ to 2 ounces of *salt* daily, and 6 or 8 ounces *limewater* in some other part of the day.

grain of Bichloride Mercury (Corrosive Sublimate) was given twice a day, to excite action of the liver, which seemed in a torpid condition, with want of activity in the general secretory system. Calomel was not used, because its weight, it was thought, is so much as to prevent its reaching the fourth stomach (abomasum). Some of the sheep recovered under this treatment, "but the results were not such as to prove highly satisfactory." Dr. Randall did not blister over the diseased membrane, because the blistering could not be brought near the seat of inflammation, except on the nose, and because of the difficulty of treating the blister on a spot so constantly exposed to dirt, rubbing, &c., and on account of the thick nasal bone intervening between it and any portion of the inflamed membrane. Now, medical men find blisters over the scalp in cases of inflammation of the brain in the human sometimes to be of the greatest advantage, and in such cases as Dr. Randall describes in the sheep, we should try blisters; taking much care to confine them in place with bandages or adhesive plaster.

Dr. Randall says this Epizootic malady prevailed in the winter and near spring. Many of the neighboring farmers found an unusual number of grubs in the head (*frontal sinuses*) of the sheep dying from this disease, and they, therefore, attributed it to this cause, and that seemed the prevailing popular opinion. In some of the *latest* cases in his flock he discovered more or less grubs, and in two or three cases an unusual number. In other cases, where the external symptoms and "post mortem" appearances were almost identical, no grubs were to be seen. For this reason and others, he would assign, when treating of grub in the head he concludes the popular opinion is erroneous.

DIARRHŒA.

This disease is not unfrequent among sheep. It is usually brought on by sudden changes from dry to green food, by too much succulent food, or by any thing which disagrees with digestion. It is simple looseness of the bowels, generally unattended by fever, and without the mucus and blood and straining which attend Dysentery. It may be mild or excessive, then being usually spoken of as scours.

Treatment.—Often confinement to dry food for a day or two will be sufficient to stop the disease. If not, then give two to three tablespoonfuls of the English "Sheeps cordial," the composition of which was given under the head of diseases of lambs. This to be given two or three times a day. Some prefer to precede this with a gentle purgative, as Linseed oil, 1 oz., or Epsom salts, 1 oz.; but the Cordial is generally sufficient. If the Cordial is not at hand, give 40 to 60 drops of Laudanum, with $\frac{1}{4}$ oz. Prepared chalk, in water, or the Laudanum may be given alone in water, or whiskey and water, if the chalk is not convenient. The quantity of the Laudanum is to be regulated in a measure by the size of the sheep and the severity of the symptoms.

DYSENTERY.

Dysentery differs from Diarrhœa in the manner just described. It is attended with fever, and is much more serious than Diarrhœa, particularly if neglected. It is produced by exposure to cold, improper food, and sometimes follows neglected Diarrhœa. It consists of inflammation of the mucus coat of the bowels, and is mostly confined to lower or larger intestines, and is attended by frequent passages of mucus, often mixed with blood.

Treatment.—Commence by giving $\frac{1}{2}$ ounce Epsom salts in ginger tea, and repeating every six hours, until several loose—not griping—passages are produced; then give two tablespoonsful of the “Sheeps Cordial” every six hours, or oftener if the passages are frequent, until they are checked; or, in place of the Cordial, give 40 to 60 drops of Laudanum at the same intervals, until the bowels are quieted. If the mucus passages return, stop the Cordial or Laudanum, and go over the same treatment just described again. Some use, in place of the Salts, Linseed oil in ounce doses. This may be better for lambs, but for grown sheep the salts are more efficient. The diet should be light at first, but as the fever subsides, or the animal shows signs of debility or giving way, increase the diet, and give some tonic or stimulant, as powdered Gentian, $1\frac{1}{2}$ drachms (90 grains), and Ginger, 1 drachm, in water, three times a day; or they may be prepared by infusing in boiling water, and permitting them to draw in a covered vessel, and given in doses corresponding to those in the powdered state. In England, Ale is considerably used as a stimulant for sheep in a prostrated condition from disease or cold. We might here, in similar cases, use Whiskey, or our American Ale or Porter. We should never think of bleeding in Dysentery, as advised by Youatt, Randall and others. Dysentery is frequently fatal, particularly in old sheep.

HOOVE, OR HOVEN, AND COLIC.

Hoove is colic, produced by eating green food, generally clover, occurring sometimes in sheep, and more frequently in cows, and occasionally in horses. It occurs more frequently when the animal is turned on clover, or luxuriant grass, with an empty stomach. Fermentation occurs, and gas is rapidly evolved, and death will generally occur by the pressure of this gas upon the diaphragm and lungs, unless relieved by medicine or artificial means.

Treatment.—To absorb this gas, Spirits of Ammonia, a tablespoonful in half a pint of Lime water, should be given every hour or two, by a drench, and along with this should be combined two or three teaspoonsful of Chloroform and forty to fifty drops of Laudanum. Judging by analogy in the cow and horse, Chloroform is a most excellent remedy. We have seen it repeatedly relieve cows and also horses; the former being particularly liable to the disease; indeed, we have never seen it administered to either without relief. We once had a cow apparently stretched out to die, with the head flat on the ground, and abdomen enormously distended. We gave two tablespoonsful of Chloroform, along with Whiskey and red pepper, and repeated the dose, the next time giving only one tablespoonful and a half of Chloroform. Relief soon commenced. We left her for the night in the clover field, where she had fallen, and in the morning had the gratification of finding her up. The Chloroform has the same good effect upon horses and on the human. Youatt only says of the treatment of Hove, gentle exercise in the early stages would be beneficial, but the shepherd generally has recourse to the knife. “He plunges it into the left flank, a little below the chine and half way between the haunch and the ribs. The gas will immediately rush out, and the wound close in a few days, without injury to the animal. The sheep, however, will not generally do as well as before the disorder, to which it will again be liable; it ought, therefore, to be sent to the butcher.” But in his figure of the skeleton of the sheep which he gives, he does not tell us where the chine or the haunch are, and he does not say what sort of knife is to be used. If a person unskilled in this operation

were to attempt it, guided by such directions, no doubt he would kill more than the disease, if left alone, would do.

Randall says of this operation : " Where the animal is swelled almost to bursting, and is disinclined to move, it is better to open the paunch. At the most protuberant part of the swelling, on the left side, a little below the hip bone, plunge a trocar or knife, sharp at the point and dull at the edge, into the stomach. The gas will rapidly escape, carrying with it some of the liquid and solid contents of the stomach. If no measures are taken to prevent it, the peristaltic motion of the intestines, as well as collapse of the stomach, will soon cause the orifices through the abdomen and paunch not to coincide, and thus portions of the contents of the former will escape into the cavity of the latter. . . . These substances will ultimately produce fatal irritation. To prevent this, a canula, or little tube, should be inserted through both orifices as soon as the puncture is made." The instrument proper to use in these cases is the Trocar, such as Doctors use in tapping for Dropsy. This slides through a Canula, which is left when the Trocar is withdrawn, and is retained in position by strings, which pass through Eyes fixed on the Canula, and are then tied around the body of the animal. All the contents of the stomach pass through this, and as the track of the Trocar heals, it is withdrawn, and the orifice closed with sticking plaster. This operation should not be used except as a *dernier resort*, and should only be performed by those who have had some experience in it, and who know the position of the stomach or paunch. Some aid is given to escape of the gas from the stomach by running a probang of whalebone, or rattan, or a grape vine, with a smooth knob or piece of sponge, gently down the gullet. A stick fastened across the mouth by a string attached to another passing over the head, tends to keep the mouth open, and favors the escape of gas, particularly when the animal chews upon it. Exercise, by forcing the sheep about, helps to expel the wind.

Colic, no matter from what cause arising, is to be treated in the same manner as Hove, except that ordinary Colic is frequently dependant on Costiveness, and being less rapid in its course, gives time for the administration of purgatives, of which Epsom salts is most useful.

LOSS OF CUD.

This can hardly be considered a disease ; it is a symptom of disease. The sheep ceases to ruminate because of disordered digestion or general disorder of system, or sickness of different kinds. Generally tonics or stimulants, as the Gentian and Ginger mentioned, change of diet and pasture, get the animal in proper condition ; and when dependent on particular disease, those diseases must be properly treated. If constipation co-exist, gentle purgatives must be used.

Having spoken of diseases of the Respiratory system (the chest) and those of the digestive organs (stomach and bowels), we come now to treat of those attacking the brain and nervous system.

APOPLEXY.

This is not a frequent disease in sheep, but occasionally occurs from over-feeding or too rapid change from a poor pasture to a rich one, with sometimes additional feed with a view of rapid fattening for the market. The symptoms are usually of sudden access, and occasionally a sheep is found dead without previous

indications of sickness being noticed. But generally something unnatural is noticed in the movements of the animal, either standing stock still or stumbling about, sometimes turning around, and sometimes leaping into the air and then falling, frequently not to rise again. When examined the eyes are found prominent, fixed and dilated, which dilatation prevents vision, which is made manifest when the animal attempts to move in any direction, as it will stumble over and fall against anything in its way. The breathing becomes labored and stertorous, the veins of the head are swollen, the pulse strong and usually slower than natural. All these symptoms are due to determination of blood to the head, produced by the causes just referred to. In the violent and rapidly fatal cases, no doubt there is rupture of a small blood-vessel of the brain with discharge of blood into and upon that organ, which by its pressure upon the great nerve centre generally causes death in a short time. If the animal lives long enough inflammation of the brain usually follows as the result of the undue quantity of blood accumulated upon one point.

The *Treatment* consists of bleeding* and purgatives. The bleeding is generally done on the jugular vein, and about a quart of blood removed, or more, if the animal is large and strong, and shows no sign of exhaustion, or giving way of the pulse (to be ascertained by feeling the pulsation of the heart or the artery along the thigh, to be hereafter described). Two to three ounces of Epsom Salts, according to size of the sheep, must be given at once, and an ounce repeated every six hours or oftener until the bowels are freely moved. The head should be kept elevated if practicable, and cold water applied by occasionally pouring a moderate quantity upon the head. If the disease seems to have been induced by the causes alluded to, then the other sheep should be removed to a less luxuriant pasture, and more moderate allowance of food be given.

INFLAMMATION OF THE BRAIN (PHRENITIS).

The symptoms of this disease differ from those of Apoplexy by being attended with more excitement, fever, and delirium. At first the animal may be dull and inactive, but soon paroxysms of excitement come on, and in a delirious state he runs over the field, sometimes attacking the other sheep, or the shepherd, or inanimate objects. The causes are nearly the same as those of Apoplexy—too stimulating food after poor pasturing, or perhaps over driving, and sometimes atmospheric influences.

The *Treatment* should be about the same as that of Apoplexy, as far as it can be applied. The Epsom Salts are generally easily administered, as the fever is attended with great thirst, and it will be drunk in place of water. Cold water should be more freely applied to the head than in Apoplexy, as there is more excitement and less danger of carrying depressing treatment too far.

TETANUS—LOCK-JAW.

The symptoms are stiffness of the jaws and general spasm of the muscles, particularly those acting on the spine, and the head and tail are drawn towards one another in a curve (Opisthotonos). These spasms come on in paroxysms, the animal being quiet in the intervals. In these intervals, however, the jaws remain

* We would not bleed in all cases; if the animal is weak, action of the heart not strong, with cool surface, do not bleed, but only use purgatives.

clenched, and there remains also more or less stiffness of all the muscles which have been in spasmodic action, and during this action there a grinding action of the jaws. The causes of Tetanus may be wounds, cold and wet, the two last being most usually the causes. Many ewes, and lambs particularly in cold climates die from these causes; and many lambs die also at weaning time and from castration.

In the *Treatment* of this disease Youatt advises bleeding, which we would not practice, but rely on Opiates, and in cases of lambs, putting by the fire (if the weather was cold) wrapped in blankets. If the bowels seemed confined, and the case not urgent, we would give Epsom Salts or Castor Oil, and then Opiates, say 1 to 2 grs. Opium (or 20 to 40 drops Laudanum*) to lambs, according to age, every three hours until the system is quieted, and if the symptoms are severe give every two hours. To grown sheep give 3 to 5 grs. Opium, according to severity of symptoms. We would not wait for purgatives if the symptoms were severe, but use enemas and purgatives while the Opiates were being given. But in addition to this we should rely much on the inhalation of chloroform—that remedy so potent for good in Tetanus in the human. This to be inhaled at the beginning of every paroxysm, until they were greatly mitigated in duration and intensity.

Epilepsy, or weakness, or loss of use of the limbs is a disease so rare in the sheep that it is unnecessary to speak of it. *Palsy* is only a symptom of disease sometimes following apoplexy and sometimes proceeding from cold.

HYDATID ON THE BRAIN.

This disease is said by Chancellor Livingston and others to have prevailed in this country, but must have been rare, and we hear nothing of it now, and shall devote but little space to it. It is a very prevalent and fatal disease in the wet and moorish districts of England and France, though it is much more fatal in the latter, probably for want of *drainage*, which is more practiced in England, where it is estimated that nearly a million of sheep are annually destroyed by it. It consists of a parasite inhabiting a watery bladder, which constitutes the Hydatid, and is found on or in the brain. It usually appears during the first year of the animal's life, when about or under six months old, and succeeds a severe winter and a cold, wet spring. "The cyst or bladder contains a fluid, sometimes as pellucid as water. If the internal membrane is then examined, and particularly with a lens, a countless multitude of little bodies, resembling eggs, and disposed in regular lines, will be found to adhere to it by filmy particles, but the fluid will not contain any organized body. At other times, the water within the cyst will be turbid, and will contain innumerable portions of apparently fibrous matter, but, which submitted to the power of the microscope, are resolved into so many minute worms. If the fluid is very turbid, that is caused by the immense quantity of worms, and the eggs will all have disappeared; when the turbidity is not so great, many of the eggs will still be observed adhering to the cyst. These worms are about half a line in length," &c. This disease is also called "Turnsick," probably from the early symptoms; the sheep appearing dull and languid, separating itself from the flock, and walking in a staggering, vascillating way, and seemingly unconscious. Then again, in the midst of their grazing, they stop suddenly, look around wildly, as if frightened, and start, and gallop away at full

* One gr. of Opium is equal to from 20 to 25 drops of Laudanum.

speed. They loose flesh, and become haggard, the eye wanders, and assumes a peculiar blue color, which is said to be perfectly characteristic of the disease. The cerebral disturbance increases, attended by a rotary motion, the head being turned one side even in grazing, and always one way. This rotary motion increases, blindness comes on, and the appetite fails, and the animal dies emaciated and exhausted, or falls down some precipice, or into the water, where it perishes. There is no remedy that is reliable. Introduction of a wire through the nostril into the brain, to break up the Hydatid, has been practiced, but is dangerous and very uncertain and has been mostly abandoned. If one cyst is broken, others may exist in the brain, and if destroyed they will be very apt to return. The remedy seems to have originated with Mr. Jas. Hogg, the "Ettrick Shepherd," who says, "When I was a youth, I was engaged for many years in herding a large parcel of lambs, whose bleating brought all the 'sturdies' (diseased sheep) in the neighborhood to them, and with whom I was everlastingly plagued, but as I was frequently knitting stockings, I fell upon the following plan: I caught every 'sturdied' sheep I could lay my hands upon, and probed him up the nostrils to the very brain with one of my wires. I beheld with no small degree of pleasure that I cured many a sheep by this operation." (Youatt.) But he admitted he had seen the sheep drop like a creature *felled* during the operation, and in some instances die in great pain. This is a barbarous method, and is little if at all practiced now. Trephining the skull where it has been thinned or destroyed by the pressure of the Hydatids has also been tried, but with not much success. The best thing is to treat the flocks in the most approved manner in cold, wet weather, to prevent it. It may exist sometimes in this country, without being recognized, or may hereafter become prevalent. A gentleman some time since wrote me about his losing some sheep with brain disease, which may have been this disease, though from the symptoms described it looked more like "Cerebro-Spinal Meningitis" (inflammation of the base of the brain and upper part of the spinal marrow). Youatt, as might be supposed, advises that sheep with this disease should be sold to the butcher.

GRUB IN THE HEAD.

"Grub in the Head," it is not believed by the most experienced and observant to be a cause of disease. It is the larvæ of the "Gad Fly," (*Estrus Ovis*) which is led by instinct to deposit its eggs in the nostrils of the sheep, generally in July and August. At this time the sheep are seen collecting in lots together, with their heads inwards and their noses to the ground, and in the dirt, or sand if it is loose and in their reach. Should the fly succeed in depositing its eggs, as they frequently do, they are hatched by the heat and moisture of the nose, and the young grubs or larvæ crawl up the nose and attach themselves to the mucus membrane of the sinuses, where they remain and feed on the secretions of the mucus membrane until the next spring. After hatching, when the larvæ commence their ascent up the sinuses of the nose, the sheep shows much uneasiness, stamps, tosses its head about, and often dashes away from the other sheep over the field. After making its lodgment, it produces no other trouble until the spring, when it begins to move down under the influence of the warm weather, when the irritation and excitement it produces seem even greater than when it made its ascent in the fall. It drops on the ground and rapidly burrows into it, assumes the chrysalis state, from which the fly emerges in due time. The male, after impregnating two or

three females, dies, and the latter, after repeating its work in the nostrils of sheep, dies also. The larvæ in the heads of sheep are, no doubt, a source of irritation, and add to the severity of catarrhs from which they suffer. and they are, as stated, a source of great irritation when they are ascending and descending the nasal cavity; but in the interval between these events no inconvenience to the sheep is perceptible, and there are no means of detecting their presence in the nose of the animal. The general belief now is that they do not produce disease in the sheep. They are found in the heads of nearly all sheep killed in the winter; not only of those supposed to have died from disease, but in those perfectly healthy which have been slaughtered for the table. Close examination does not show any disease in the head of sheep containing these "grubs," and the popular opinion on this subject must be unfounded. Those who hold this opinion attribute all the deaths occurring in sheep no matter what the symptoms may have been, so they find the "Grub in the Head."

Treatment.—Some smear the noses of sheep with tar occasionally, believing that the odor will drive off the fly, or give them salt sprinkled over with tar, in eating which, the tar becomes smeared over the noses. Another plan adopted is to run a furrow through the field to turn up fresh dirt into which the sheep may thrust their noses on the approach of the Gad Fly. Others blow tobacco smoke up the nostrils through a pipe, which they assert will drive them out.

This larvæ or grub, we think, we omitted to say, is rather larger than the bot in the horse, is white when half grown, and darker at its full size, and has two small brown patches by the side of each other at its tail. The Gad Fly looks somewhat like a large common bee, and is not as large as one would expect from the size of the larvæ, is of brown color, with wings striped and marked; head large in proportion to body, eyes have the appearance of net-work, and of deep, changeable green color, small, and in the small space between them are placed three other minute eyes in the shape of a triangle, visible in a good light or by lens of small power. The rest of the head is yellow, and looks as if perforated by a number of small holes like a piece of sponge, at the bottom of each of the cavities a small black spot appearing,

ROT.

This is a singular disease, and one which has been very fatal in European countries, where it has prevailed extensively from early ages. It has also prevailed with fatal effects through the Northern and Eastern portions of the United States. In Virginia it has occasionally occurred, though, as Green and Farrar, of Orange, write me, our naturally drained soils and their open texture, with liberal use of salt, very generally prevent it. Youatt says more than a million of sheep and lambs die annually of this disease in Great Britain, and in 1830-31, the number was more than doubled.* Many sheep die of it in France, Germany, Spain, and other European countries. The symptoms at first are, unfortunately, obscure, for then is the time that some treatment might avail. The animal begins to be languid and lag behind his fellows, but there is no loss of condition; but, on the

*In the year June 4th, 1880, the loss estimated by Prof. Sheldon, an English scientist, at four to five millions sterling (twenty to twenty-five millions dollars). It is feared the loss will be seriously augmented the present year. Wide districts are depopulated of sheep, and in many others a large portion has succumbed to the malady, while thousands upon thousands "have been killed to save their lives."—*Shepherds Nat. Journal.*

contrary, an increase of fat, which has been taken advantage of to prepare them for the butcher. The disease is supposed to be brought on by wet, and by grazing on moist, boggy lands; and Mr. Bakewell, of England, was in the habit of overflowing certain of his pastures, then turning the water off, and putting on the land the sheep which he wished to prepare for market. In this way the disease, which seems to be one of the Liver principally, was contracted, the animal rapidly fattened, and he thus obtained five or six weeks' advantage over his neighbors in the markets. As the disease becomes established, paleness of the membranes, particularly of the eye, is observed, and though the eye may be injected, this paleness and afterwards yellowness is noticed in the contents of the blood-vessels. The "Caruncle," a small gland, observed as a prominence where the lids meet, becomes yellow. The condition of this Caruncle is said to be at all times a good means of judging of the health of sheep. If it is bright red, the animal is in good health; if pale, may still be healthy, as this is often the result of feeding on grass; but if yellow, it should be rejected as unsound. If the wool is parted, the skin will be found to have a yellowish tinge, or pale red, and sometimes, later, yellow and dark spots are observed on the skin. The wool separates easily from the skin, emaciation commences, with increased dullness, with greater paleness of the mucus membranes, the eyelids becoming almost white, and afterwards yellow. The yellowness extends over the whole body, and a watery effusion often takes place under the skin, constituting Dropsy.

The duration of the disease is uncertain, sometimes proving fatal soon after being attacked; but it is usually chronic, lasting from three to six months, the sheep at least losing flesh and pining away, the death being frequently hastened by obstinate Diarrhea.

Post mortem examination shows the disease to be seated in the *Liver*, and it is indeed a slow inflammation of that organ, attended with parasites in the biliary ducts (tubes conveying the bile from the Liver to the bowels). Youatt says the Lungs are filled with *tubercles*; if this is so, there would seem to be a combination of diseases, particularly as the heart, he says, is enlarged and softened, the kidneys unhealthy, peritoneum diseased, bowels adherent together, as the result of inflammation of the peritoneum; mesenteric glands enlarged, &c. But the principal force of disease is expended upon the Liver, and it is probable that this is the starting point, and the others not necessary combinations. The Liver is pale, livid, and is broken down by the slightest pressure, though some parts are sometimes hard and schirrhous and ulcerated. In consequence of the inflammatory condition of the Liver in the early stages, the secretion is increased, and not much vitiated, and this renders the digestive powers more energetic, which accounts for the increase of fat and flesh of the sheep in the beginning. But as the disease progresses, the Liver becomes more or less disorganized and the bile vitiated, which causes an entire derangement of the digestive organs, which in turn produces disease of the blood, and consequent affection of most of the organs of the system.

The parasite found in the biliary ducts is called *Fluke*. This is also found in the biliary duct of other animals, as the Goat, Deer, Horse, the Hog, Rabbit, Guinea Pig, &c. It is from three-fourths to one and one-fourth inches long, and from one-third to one-half inch in greatest breadth. In the intestinal canal, and in the biliary ducts, are also found very minute oval particles, supposed to be the spawn or eggs of the parasite. In the fall and winter, these may be occasionally seen

in the dung of the healthy sheep, and in great numbers in that of the rotted sheep. These eggs are believed to be taken in with the food; they maintain their vitality for a long time, and probably find their way into the grass and the hay the animal eats. Or they may have existence, independent of those found in the body, about the marshes or ponds and rivers. It is said that Leeuwenhoeck found 870 Flukes in one Liver; but in the cases where the sheep had died of the rot, not more than ten or twelve were found (Youatt). The question, of course, has been discussed, whether the Fluke is the cause or effect of the disease. While it is generally believed to be effect, or to follow the disease, there is no doubt it adds to the severity of the symptoms. The analogy of worms and parasites in the human and other animals would lead to this conclusion; and the fact that the Fluke is found in healthy Goats, Hogs, Rabbits, &c., tends to the same conclusion. It is said that a few of them are frequently found in dressing sheep for the butcher, without any indication of disease of the Liver. They add to the mischief in rotted sheep by proving a source of irritation, as Lumbicoids (worms) do in children, and they obstruct the natural flow of bile through the ducts, besides distending these ducts unnaturally.

Treatment.—Mr. Youatt, of course, advises *bleeding* in the early stages, then purgatives, plenty of salt, and afterwards tonics of Gentian and Ginger, and removal to fresh pastures, and particularly to a salt marsh, if accessible. We, of course, should omit the bleeding, would keep the bowels regular with Epsom Salts, or common Salt, which, in doses of two to three drachms morning and night, is a gentle purgative; would follow the advice about the pasture and salt marsh, and give the Gentian and Ginger as soon as there was any sign of debility or want of appetite. One to two drachms of each, powdered, are given morning and evening, combined with the salt. If the salt purges after the first stages reduce the quantity, but still give some as a tonic and appetiser. This disease is not infectious. Of course, wet pastures must be avoided when seeking change of pasture, as this is believed to be a prominent cause of the disease.

HOOF AIL, OR HOOF ROT.

This is a very troublesome affection, and has prevailed in this country to a very considerable extent, and is sometimes heard of in Virginia, though our well, naturally drained lands and the wearing away of the hoof by the stones which prevail, generally prevent it. The first symptom of the disease which is noticed is lameness in one or both feet. Youatt says: "The foot will be found hot and tender, the horn softer than usual, with enlargement about the coronet, and a slight separation of the hoof from it, with portions of the horn worn away, and ulcers formed below, with a discharge of fetid matter. The ulcers if neglected continue to increase; they throw out fungus granulations, they separate the hoof more and more from the parts beneath, until at length it drops off." Dr. Randall says, as he has seen the disease in New York, instead of the hoof being softened, it is hardened, and that he has never known a hoof to drop off. He says he had a flock of eight hundred sheep infected by putting with them a few valuable sheep received from abroad, and that every one of the sheep contracted the disease, some in one, some in two, and others in all four feet, and that in some cases as the fourth foot was attacked it would be breaking out again in one of the cured feet. The first appearance in the diseased foot is erosion attended with inflammation and heat in the *back part* of the cleft, just above the heels. There is a

sanious discharge which keeps the foot moist, and as the inflammation extends, the sheep begins to limp, but no external appearance of disease in the foot is noticed. Unless arrested by treatment, the inflammation and ulceration extend, sinuses are formed in the fleshy sole, from which exude offensive matter; the foot becomes a mass of dark, putrid disease, the bottom of the hoof disappears, and the outerwalls hang only by the detachment to the coronet. The forefeet are generally first attacked, and usually but one of them. At first but little constitutional disturbance exists, and the animal continues to eat well, but by the time there is any serious disorganization in the structure of the foot, fever commences, the appetite declines, and emaciation commences. If both forefeet become affected, the animal moves about with difficulty and much pain, grazing on its knees, and if forced to bring its feet in contact with the ground evinces much suffering. Before this time, eggs have been deposited by the fly in the sores, and soon they are filled with maggots, which add to the trouble and suffering. The maggots also find their way through the wool and burrow into the skin and integuments, and the poor animal is almost eaten alive; death soon supervenes.

One or all the feet may become diseased, and sometimes while some of the feet are in a wretched condition, one or more may remain in a healthy state.

Causes.—This is no doubt a contagious disease, though some of the learned Veterinary Doctors have denied it. The instance related by Dr. Randall is evidence of this fact, but there are hundreds of instances known of its spreading from contagion. Dr. Randall's flock did not take the disease simultaneously, as would have occurred if it had originated from local or ordinary causes, but one was attacked after another. Dr. Randall produced the disease by inoculation of a well foot with the matter from a diseased one. Youatt says the disease is contagious, yet may be produced by natural causes. After describing the symptoms and course of the disease, he says, "all this is the consequence of soft and marshy pastures. The Mountain, or Down sheep—the sheep in whose walk there is no poachy ground—if he is not actually exposed to infection by means of the virus, knows nothing at all about it; it is in the yielding soil of the low country that all the mischief is done." Dr. Randall, on the other hand, denies that the disease has ever appeared in this country without contagious origin. When a disease is known to be contagious or infectious (we use the terms synonymously) the general belief among medical men is that it has no other origin. No one believes that Small Pox or Scarlet Fever originates *de novo* now, though in the beginning, it must have had a starting point. It is, we suppose, possible that there might be a concatenation of circumstances and bringing together of elements that might give a starting point to the contagion, and if not, we are always inclined to think they could thus be traced, if all the facts were known. If a flock of sheep were pasturing in wet, boggy ground, this would be a strong predisposing cause of Foot Rot. Then, if it existed in the neighborhood, and in the air, that flock would be more likely to become diseased than if they were pasturing on high ground.

Treatment.—This should be commenced as early as the disease is detected, and first, the diseased must be carefully separated from the well sheep, for not only will they infect the well ones, but the sheep which are treated and cured, if kept with the affected ones, will again contract the disease, and the flock may be kept with foot rot for years.

Before making any application, the hoofs, if they are long, and especially if they are dry and tough, must be trimmed and shortened with the toe-nippers or

bone-nippers used by Surgeons. Before doing this, care must be taken that the sheep are not driven through the mud and dirt; and if they are dirty, an assistant should wipe them out with a rag and bucket of water. The hoofs are usually dry and hard, and if the sheep could stand for a while on wet straw or in a brook with gravelly bottom, it would make the trimming easier. If in the first stage, and there is no ulceration in the cleft above the walls of the hoof, no paring may be necessary, but if ulceration exists between the hoof and fleshy sole, the ulcerated parts must be entirely denuded of their horny covering, no matter how much time and trouble it may require, taking care not to wound the soft parts so as to cause bleeding. If the ulceration is far advanced and filled with maggots, pour some Spirits Turpentine over the part, which will expel the latter, unless it be a few which may require to be picked out; then remove all the loose portions, even if it takes the entire hoof. This will expose clearly all the ulceration, which should be *thoroughly* cleansed with warm water and soap. If there are any large fungus granulations, they should be removed with scissors, and the bleeding, if any, stopped with temporary bandaging or pressure with soft rags. Many local applications have been recommended to cure the ulceration. Youatt recommends Chloride Antimony, to be applied by means of a little mop, lightly, where the surface has a healthy appearance, and more severely where the fungus granulations have been cut off or where they are prominent. He says there is no application equal to it. More generally, of late years, Blue Vitriol (Sulphate Copper) has been preferred. Randall says a saturated solution of the Blue Vitriol, in the first and second stages, before sinuses are formed, is the best application; but that in the third stage, where the foot is a festering mass of corruption, Lunar Caustic is to be preferred, but that is too costly. We should not think so if the stick of caustic is cautiously used, unless the flock is a very large one. He says then the Chloride Antimony or Nitric or Muriatic Acid, or even Sulphuric Acid, may be substituted. The way he uses the Blue Vitriol is to dissolve as much as water will dissolve and pour it into the foot from a vial with cork and quill. Where sinuses exist (which are little narrow tracks running through the flesh), it is difficult for the remedy to reach any but the more superficial portions of the sore, and the healing may be superficial. We should think this might be obviated by using a little glass syringe and throwing the solution through the sinuses, protecting the hands with oil or lard. But the caustic we should prefer to all others is the *Chloride Zinc*, as in the human, none other acts so well in similar cases. It destroys these granulations, and all the diseased tissues, and when the slough it forms, separates it leaves a new surface which heals rapidly. It is used by making a paste of one part Chloride Zinc, and three or four of flour, made into a thin paste, and spread over the part with a spatula; or, in the case of sheep, it would be more conveniently used in solution in same proportion of water. One or two applications would be sufficient. Before using these applications, unless it be the last, I would open up all the sinuses with a Bistory and Director, from the bottom, so as to expose the whole diseased surfaces. The Chloride Zinc being very active, might not require this, unless it be some long, tortuous sinus. Randall says in a large flock, after paring the feet, he found it best and more expeditious to dip the feet in a tub of the solution of Blue Vitriol, made by dissolving it in water as hot as could be endured by the hand even for a moment. One sheep was placed in the tub after the feet were pared, and held by an assistant until another was ready to place beside it, then a third was brought up, and the first one was taken out,

and the third put in his place, and so on, each sheep remaining in about five minutes. The solution was about four inches on the bottom of the tub, and kept at that by additions of hot solution of the same strength. Thus were treated a hundred sheep, the disease being taken in the early stage, and Dr. Randall says the cure was *perfect*. The hot liquid, he thinks, penetrated to every cavity of the foot. He says the lateness of the season was also favorable, as in cold weather the ulcers of ordinary virulence, discharge no matter to inoculate the healthy feet.

Care should be taken not to put healthy sheep in pastures where sheep with this disease have been pasturing until the winds and rains have had time to dissipate and destroy the poison which has been left about the grass, straw, stubble, &c., in the field.

Sheep are subject to a mild disease of the foot called "Foul," which is an irritation in the cleft of the foot somewhat resembling "Foot Ail" in its early stage. It produces lameness, but no serious trouble, disappearing often without treatment, is non-contagious, and appears in the wet weather of spring and fall, instead of the hot weather of summer when Hoof Ail most prevails. If it does not get well of itself, a weak solution of Blue Vitriol, followed by a coating of warm tar, will cure it.

THE SCAB.

This disease has not prevailed much in the United States, but is very prevalent in England, where it has produced much loss in wool and flesh, and in some cases causing the death of the animal. It is analogous to mange in horses, and itch in the human being, produced by the same insect, the *Acarus*. The symptoms are great restlessness, the animal rubbing itself against trees, posts, &c., scratching with its feet, biting its sores and tearing off the wool; the little pustules formed by the insect are broken, the matter escapes and forms *scabs*, covering inflamed sores, and hence the name. The sores extend, unless checked by treatment, causing increased irritation and misery, and resulting in death. The *Acarus* finds his way through the wool, penetrates the skin, leaving a minute red point; in about twelve days a little swelling begins, which may be detected by passing the finger over it, the pustules form, and about the sixteenth day break and form scabs. It is about the twelfth day, when the swelled points appear, that the sheep begins to rub itself, and as the rubbing increases with the increase of the disease, some of the wool falls off, and the fleece becomes hard, dry, and irregular. The disease is contagious, though Mr. Young, an English writer, says he never observed it to be contagious, but it is evident he must have seen some other itching disease in sheep, as he says "they have clear skins, without the least sign of scab." The insect (*Acarus*) spreads from sheep to sheep, and the well sheep contracts them from the rubbing places of the diseased sheep, and from pastures where they have used. This shows the importance of separating the flock, and putting the well sheep in a fresh pasture, and removing each one which shows signs of disease by rubbing. Mr. Youatt says "the post-mortem" appearances are very uncertain and inconclusive. There is generally chronic inflammation of the intestines, with the presence of a great number of worms. The Liver is occasionally schirrhous, and the spleen enlarged; and there are frequently serous effusions in the belly, and sometimes in the chest. But these must be complications arising from general impaired condition, and cannot be necessarily a part of a cutaneous disease, which is sufficient if unchecked to produce death by the constant and severe irritation.

Treatment.—A variety of remedies have been used for this disease. Mr. Spooner prefers Arsenic—half pound to twelve gallons of water; Mr. Youatt, Mercurial Ointment—one part to three of lard for bad cases, and one to five of lard in milder cases and lambs, not using more than two ounces to the sheep and one-third as much for lambs; and Mr. Randall says he cured a flock of 150 sheep by a strong decoction of Tobacco. Others prefer Sulphur, one pound, Tar, half pound, Lard, two pounds (first mixing together the two last); others use Corrosive Sublimate (Bi-chloride Mercury), half pound to seven gallons of Whale or other oil. The mercurial preparations are powerful insecticides, and destroy the *Acarus* in the human, but Sulphur in the human is a most efficient remedy for this insect-producing “itch,” and we should first try it in sheep, as it is an entirely safe remedy, and we believe would be efficient. The Mercurial preparations sometimes produce salivation, which is very objectionable in pregnant ewes and lambs. If the Corrosive Sublimate is used we should think the best and most expeditious way would be to dissolve it in water. In using these preparations the wool should be sheared off from all the diseased parts, unless in cold weather, then the wool must be separated in rows four inches a part down to the skin, first rubbing in the preparation in one row, then closing it and opening another space, and so on. For most of these preparations one application seems to be sufficient, but for the Sulphur, which is not so active, we would prefer two or three.

Merino sheep are said to be much less subject to Scab than the long-wooled sheep.

LICE AND TICKS.

Arsenic and the Mercurial preparations destroy these. Mercurial ointment one part to five, carefully used, is efficient. Tar and Turpentine also will answer, but are not so certain as the Mercurial ointment.

THE FLY.

In the first warm weather certain flies begin to deposit their eggs on the wool of the sheep, and if the sheep has Diarrhoea, the excrements accumulate around the tail and the eggs will be deposited there, producing maggots, with great annoyance to the animal. The head is also much exposed to their attacks. The maggots, as soon as hatched, burrow under the skin, and by their irritation sometimes produce death. They sometimes get under the horns, where they lie close to the head, and then, if not removed, destroy the sheep. When around the tail the wool must be removed, and Tar and Turpentine applied. When about the head, the same remedy will answer, but if the head becomes sore, a plaster of one pound of Tar and two parts Beeswax, melted together and spread on leather or thick cloth while warm, should be applied, and sewed around the head, or some persons apply it to the head while warm without any cloth, and sprinkle a little short wool over it. When they get under the horns boiled Tar is the best remedy, and if this is applied under the horns at the time of marking it will keep off the flies, and act as a preventive. Mr. Hogg (Youatt) asserts that fish oil will kill the fly and keep them off, by the odor it imparts to the wool.

FRACTURES.

The bones of sheep are easily broken, and easily repaired. Bring the fractured ends of the bone in apposition, and put around a piece of wet leather, and bandage

it, or apply a bandage about three inches wide around the limb and as long as necessary, and then smear over this tolerably thick starch. This will be moulded to the limb, and keep the bones closely together. If the limb swells the bandages must be loosened some. In the case of the starch bandage, this had best be cut open by a pair of strong scissors or a sharp knife, suffered to gape sufficiently to relieve the swollen limb, and then again to be bandaged and some starch to be re-applied if there is any difficulty in keeping the apparatus in place. If there is much fever it will be well to give a dose of Epsom Salts.

LOSS OF CUD.

This is sometimes spoken of as a disease. It is not, but when the sheep ceases to ruminate (loss of cud) it is evident that the system is very considerably out of order. The animal should be separated from the flock and watched, and symptoms treated if any serious arise. If the bowels are not well open it will be proper to give a dose of Epsom Salts.

MODE OF ADMINISTERING MEDICINE.

The medicines for sheep should be administered in a fluid state by drenching, though sometimes in fever they will drink them. If not given in a fluid state it is not apt to reach the fourth, or digesting stomach; if it remains in the ruminating stomach, its walls are so insensible that they are not acted upon except by doses of improper size. Mr. Youatt says if the animal forcibly gulps down fluids, or they are given hastily and forcibly by the attendant, they will fall on the canal at the base of the gullet with considerable momentum, and force assunder the pillars and enter the rumen. If drank slowly or administered gently they will trickle down the throat and pass on through the maniplus to the stomach.

METHOD OF BLEEDING.

Bleeding from the ears or tail, as generally recommended, does not often furnish enough blood to do any service where bleeding is necessary. Bleeding is performed from the eye vein by a lancet or sharp knife, on the pouch below the eye, which is pressed down and a cut made inward toward the middle of the face. Danbenton (Randall) recommends bleeding from the angular or cheek vein, thus, "on the lower part of the cheek at the spot where the root of the fourth tooth is placed is marked on the external surface of the upper jaw by a tubercle. This tubercle is a certain index to the angular vein, which is placed below. . . . The operator takes the sheep between his legs, . . . he touches the right cheek at the spot nearly equi-distant from the eye and mouth, and there finds the tubercle which is to guide him, and also feels the angular vein swelled below this tubercle; he then makes the incision from below upward, half a finger's breadth below the middle of the tubercle." When the vein ceases to be pressed on it ordinarily ceases to bleed. If not, a pin is passed through the lips of the orifice and a lock of wool or thread is passed around them.

For full bleeding, the jugular vein is greatly resorted to. The sheep is to be firmly held by an assistant with its rump against a house; some of the wool is cut away from the middle of the neck over the vein, and a ligature passed around the neck by opening the wool, and tied below the short spot near the shoulder. After bleeding the orifice is to be secured, as already described.

Bleeding, as a general rule, should be resorted to near the commencement of the disease; it should be rapidly done, so as not to exhaust the strength by slow bleeding, as the sheep, as before remarked, has less blood, in proportion to size, than other animals, and does not bear bleeding so well. The orifice, therefore, should be of good size and in course of the length of the vein, so that the desired effect may be produced without loss of too much blood. The quantity to be taken must depend upon the effects produced upon the constitution and general system, not upon admeasurement.

PLACE OF FEELING THE PULSE.

By placing the hand under the left side near the shoulder, as in the horse, we feel the pulsation of the heart. The pulse may be felt in the artery of the thigh, about the middle as it passes in an oblique direction across the inside of the limb. The pulse beats from 65 to 70 per minute, sometimes perhaps a little more; pretty much the same as in the human.

CORRESPONDENCE.

During the year I addressed to prominent and practical sheep-breeders in the State the following circular, and received the replies snbjointed, which are well worthy of publication :

CIRCULAR No. 20.

COMMONWEALTH OF VIRGINIA.

DEPARTMENT OF AGRICULTURE,

RICHMOND, 1881.

MY DEAR SIR :

Will you be so kind as to give me your views in regard to the different breeds of sheep, and the best mode of breeding and general management, stating—

1st. What breeds and crosses you prefer; what breeds are you keeping now, and have kept, with their merits and demerits?

2d. At what age should the ewe take the buck, at what age should the buck be permitted to serve ewes, and at what time of the year should they go together?

3d. What breeds do you prefer for mutton, for wool, and for lambs?

4th. What is the size of your flock, what crosses have you made, and what has been the improvement in the weight and quality of wool and carcass?

5th. What are your annual sales of wool, mutton, and lambs, prices obtained, and profits of investment on each?

6th. What is the character of your pasture lands, and what grasses do you prefer for sheep? How do you feed in the winter?

7th. What are your arrangements for shelter and protection in winter, and your system of winter feeding and treatment?

8th. Do you separate the *combing* from the *short* wool? What is the proportion of each, and what prices do you get for each kind? Also, prices for washed and unwashed wool?

9th. Are there any woolen factories in your county? If yes, how many, and where located?

10th. When and where do you sell your wool, lambs, and mutton? How are they sent to market, and at what cost?

11th. Please state all you know about the diseases of sheep, and the remedies.

12th. Do you raise turnips or other roots for your sheep?

13th. Have you suffered from dogs among your flocks? Do you keep "Shepherd dogs" or use any means to protect your sheep? What do you estimate the loss for your county from dogs in number and value of sheep to be?

Please reply as early as possible, and oblige,

Yours, very respectfully,

THOS. POLLARD,

Commissioner of Agriculture.

I wish to use the information thus obtained for a work, "Sheep-Husbandry for Virginia," I am now preparing.

VALLEY CENTRE, HIGHLAND CO., VA., July 15 1881.

Dr. THOS. POLLARD,
Commissioner of Agriculture :

1st. I prefer Southdown, Cotswold, and Leicester mixed, as they afford very good wool and excellent mutton. I am now keeping Southdown and Cotswold mixed with common country sheep; they afford excellent wool, but do not weigh so heavily as the full-blooded Southdown.

2. The ewe should be permitted to go with the buck at the age of 18 months. The buck can be allowed with the ewe at the age of 12 months. The buck and ewes should be put together about the 15th October.

3. I prefer the Southdown for mutton. I prefer for both wool and lambs the Cotswold and Leicester mixed.

4. My flock is small; I have made various crosses :

1. Merino with common country sheep.
2. Southdown with common country sheep.
3. Cotswold with common country sheep.
4. Southdown and Cotswold with common country sheep.
5. Leicester with common country sheep.
6. Leicester, Southdown and Cotswold, without being mixed with any other.

I find that the Leicester, Cotswold and Southdown, mixed, are far preferable to any other; they make an improvement on the wool to a great extent, or about an increase of $2\frac{1}{2}$ to 3 pounds per head, and are very nearly as large in carcass as the full-blooded Southdown.

5. My annual sales of wool per head are	\$2 40
Mutton.....	5 00
Lambs.....	3 00
The profits of my investment per head, to take the entire flock, are...	7 50

But I have to keep them about 12 months on an average.

6. My pasture lands are high and rolling, with principally a blue-grass sod. I prefer the blue grass for sheep. I feed nicely-cured timothy, clover, and blue-grass hay on the clean ground, and I feed oats and shelled corn, mixed in troughs prepared for the purpose.

7. My arrangements for shelter are sheds and stables. I allow them to use these stables when the weather is very severe; when not cold I keep them in the open field.

8. I do not separate the combings from the short wool. I sell all together at an average of 40 cents per pound. Washed wool sells at 40 cents; unwashed 27 cents per pound.

9. There are no woolen factories in my county.

10. I sell my wool to the merchants, who send it North. I sell mutton at the Warm springs, Bath county, Virginia. I send them away on foot, at a very small cost, as it is only 20 miles. I sell lambs to sheep-raisers for stock sheep.

11. I know but little about diseases of sheep, as we have an unremarkably healthy country. Rot is our principal disease, in which sulphur, with English resin, is a good remedy. Give the sulphur and resin in their feed.

12. I do not raise either turnips or other roots for sheep.

13. I suffer comparatively little from dogs among my flock. I do not keep "Shepherd dogs," nor use any particular means of protection for my sheep. I should not estimate the loss of the whole county from dogs to be more than 75 head of sheep, or about \$300.

Yours, very truly,

FLOYD A. DOYLE.

FORK UNION, FLUVANNA Co., July 1st, 1881.

Dr. THOS. POLLARD:

Dear Sir—In answer to your circular No. 20, will say, I commenced keeping sheep 8 years ago. I purchased of one of my neighbors a few head of common sheep, not knowing anything about the breed. I then sent to New York and got a thoroughbred Southdown ram, known as the Webb stock of Southdowns. My sheep are now looking well.

1st. I prefer the Southdown, they being easy keepers, not too heavy to roam over the hills and ridges to graze, very gentle and docile, easily taught to come up to the pen by call or whistle, making the best carcass for the butcher and producing a fine quality of medium wool. I am in the habit of penning my sheep every night with cows; dogs are not so apt to attack them, and have never lost one while in the pen.

Anything that disturbs the sheep at night will arouse the cows, they move around and shake the bell, which causes some dread on the ear of poachers of all kinds. Circumstances sometimes occur that prevent me from penning my flock, and at such times I am apt to loose a sheep or lamb.

I have lost many by dogs; have shot a good many dogs, and have never known but one hound to attack my sheep; that was a young one, and like poor old Tray was found in bad company, a cur dog—both of which I secured with my gun.

2d. I do not think it makes much difference in the long run; all my early ewe lambs take the buck and drop a lamb the next spring.

It undoubtedly interferes with the growth the first year, but the next year they will come out all right and stand one lamb ahead of ewes kept from the buck until the second year. I prefer to keep the young buck from the ewes until the second year, especially if there are many to serve. I prefer to have lambs dropped in January and February; they make large sheep; but those lambs that come late in the spring never do well or grow to a large size with me.

3d. I prefer the Southdown.

4th. I wintered last year 26 ewes, and the manure saved in the pen made six four-horse wagon loads.

5th. _____

6th. Pasture lands consist of old fields; broom sedge being the principal pasture. I feed grain, oats, corn, buckwheat, orchard grass, clover and corn fodder only when the weather is severe or the ground covered with snow.

7th. I pen and house them night and day when the weather is severe. But when the weather is mild they graze through the day.

8th. Do not separate any—all being quite alike.

Received 26 cents per pound for unwashed wool this season, all trash being picked out of it. Have tried tub-washing, and find it looses about one-third in weight. If it is well and properly hand-picked it brings nearly as much as washed. Do not know whether dealers or middlemen prefer wool washed or not.

9th. None that I know of.

10th. I have no particular time to market either.

Richmond the only market via Richmond and Alleghany Railroad.

11th. The only disease that has ever troubled my sheep is of a dropsical nature. The first symptom observable is a swelling under the jaws, increasing after a day or two and spreading around the sides of jaws and neck. The sick sheep drops behind the flock, lays down in a fence corner, or some out of the way place, and after a few days dies. Sometimes they live six or eight days, others die in two or three.

Have taken them up and tried to help them, and the only apparent good I could do was to prolong life a few days. On skinning the carcass the blood seems to have turned to water, the flesh very white, the skin very thin, like paper. The lungs, liver, &c., presenting no unnatural appearance (to me). Some are quite fat, never very poor. I have written to veterinarians in New York, describing as near as I could the symptoms, but have not been satisfied with their answers. I may not describe the symptoms properly or intelligibly.*

12th. Do not raise roots specially for sheep.

13th. I keep one shepherd dog, a "Scotch Collie." Not well acquainted enough in the county to estimate the loss.

I think sheep owners should be protected by a law making the owner of worthless curs that kill sheep pay for the loss. If they plead poverty, to be *punished* in some way that would deter them from keeping such animals.

I thank you for reports, &c., and hope you may find something in the above that will be of use to you.

With much respect and esteem, I am, &c.,

G. UNDERHILL.

CARRVILLE, NANSEMOND, VA., June 20, 1881.

DR. POLLARD :

My Dear Sir,—In reply to the questions of your circular I will state, in the first place, that very little attention is paid to "Sheep Husbandry" in this (Nansemond) county. Not one farmer in fifty has any sheep, and those who have, like myself, don't know what breeds they have or prefer. I have always had a small flock (15 or 20) just for "eating purposes," as my neighbor, a very successful farmer, said in reply to a question contained in your circular, and have devoted some attention to sheep.

The ewe should not take the buck the first year, nor should the buck be permitted to serve ewes the first year of his life; and they should, I think, go together about first of September.

*This is what Youatt calls "Acute Dropsy," produced generally in old sheep by cold.

Norfolk is our market for wool, lambs and mutton; accessible by railroad; cost of transportation moderate; price unwashed, 25 cents per pound.

Loss by dogs in the county, about 40 per cent. annually.

There is no woolen factory in this entire section.

Know nothing of diseases of sheep, or remedies for same.

Very truly and hastily,

THOS. H. BARNES.

BOWERS, SOUTHAMPTON COUNTY, VA.

MY DEAR SIR:

1st. Southdowns.

2d. Ewe should take buck at 18 months of age; the buck should not serve a ewe till he is 18 months old.

3d. Southdowns.

4th. Sixty head. I first introduced a full-blood Southdown buck into a flock of 100 ewes, with marked improvement in lambs. I then sold out the whole flock to neighbors and again bought a small (first prize) flock of Southdowns.

5th. I obtained from one buck, a few days since, 11½ pounds good wool; have not yet sold; have sold heretofore in dirt at 25 cents per pound.

6th. Orchard grass and white clover.

7th. Shelter every night; feed on turnips, peas, and oats.

8th. _____

9th. None.

10th. Sell my lambs in Norfolk and in North Carolina.

11th. My sheep have catarrh—no other disease. I would like to know a remedy.

12th. Yes.

13th. No. Other persons have lost one-fourth from dogs.

Yours truly,

MENALCUS LANKFORD.

SHIRLEY, CITY POINT, VA., 3d August, 1881.

MR. THOS. POLLARD,

Commissioner of Agriculture:

Dear Sir,—Your circular No. 20 received. I reply to your questions:

1st. I prefer Cotswold, high grade—that is, Southdown, or any medium-sized ewes to start with—and pure Cotswold rams brought to the flock for five or six years in succession, a new ram each year, killing off ewes over five years; then get common ewes and begin again. This has been my plan: Merits—large early lambs, healthy sheep; demerits, indifferent mutton to eat.

2d. Ewes, if born before Christmas, take the buck in July or August, and have as good lambs as the old sheep, though I prefer 18 months' ewes to breed. Late lambs had better not take the buck at all; they make a bother every way; better kill them. Ram should be 2 years old.

3d. Southdown 5 years old for mutton ; Cotswold for wool ; and lambs *to sell*.
 4th. My flock about 60—i. e., 90 in March, to 50 in August ; Cotswold or Southdown, and other unknown breeds.

5th. Wool sold 1881, 380 pounds ; 1880, 362 pounds ; general averages, 7 pounds to the fleece. Muttons, very few sold ; lambs, 25 to 40. Wool—The market price ; lambs \$4 last two years ; before that, from \$3 to \$5, averaging \$6 for ten years. Profit very large on investment, but questionable whether there is any profit considering the injury sheep do the clover in four-shift system.

6th. No pasture land ; only the clover and native grasses, cultivating a grain farm in four fields—half in wheat, one-fourth in corn, one-fourth clover. I pull a little fodder, and feed on that when the ground is covered with snow ; no grain. To fatten sheep, the timothy field during winter and spring beats everything ; but they won't breed on it—get too fat.

7th. A slab shelter is always put up in the field the sheep use, and the fodder and salt put there, as much as they will eat clean ; but they go there only in rainy weather or cold winds ; clean straw always under and ten yards in front of the shelter.

8th. I never separate the wool, nor wash it ; nearly all combing I ship to Philadelphia, and get a few cents more than Richmond market price. Cost of getting to Philadelphia by steam, same as by river boat to Richmond.

9th. No woolen factories in this county.

10th. Sell my wool the first steamer after shearing—generally on the first of May ; lambs and mutton to Richmond butchers, waiting till they call for them ; never send them to town unless ordered by a butcher.

11th. Know nothing about sheep disease, never saw any.

12th. Don't give the sheep turnips ; keep them for milch cows.

13th. Never had dogs to kill my sheep ; hear of such losses by some farmers in the lower part of Charles City, but can form no estimate. I keep no "Shepherd dogs," nor dogs of any kind ; shoot all I can get near enough to on my farm, and would like to prevent their coming on it.

My farm has five 80-acre fields—four of them as a grain farm, and one in timothy, as long as it will run well, when it becomes foul put in corn, and another field taken for timothy ; raise 40 hogs to kill, and keep 30 kine.

Very truly yours,

R. R. CARTER.

GRAYSON COUNTY, VA., June 22d, 1881.

Hon. THOS. POLLARD :

In reply to your inquiries contained in circular, I can only give you a few facts obtained from a limited experience with sheep, having been engaged more particularly with other kinds of stock. For the last few years I have increased my flock and given some attention to sheep, believing them to be equally as profitable as any other stock we raise. My flock now numbers 260 head, being the original stock crossed by the Cotswold. This crossing will improve greatly the quality of the sheep and wool, in quality and quantity, leaving a very good mut-

ton animal. The further the original stock is removed, the better the quality of wool becomes, and the sheep fatten more kindly. I have never kept any other breeds long enough to speak advisedly of their merits, nor have I continued the breeding and crossing of my flock sufficiently to fully test the advantages, having frequently disposed of my entire number, and then had to begin again by falling back upon the original stock of our county. Every effort, however, has been marked with very great improvement. At one time I purchased a few ewes of the Southdown, all of which were soon after killed by the dogs. To be well developed, ewes should not bring lambs until the second year, nor should bucks be put to service before that age. I have commenced with our native sheep, which would not produce more than three pounds of very inferior wool, and by crossing twice have been able to get as high as six and a half pounds of good wool. I have sold wool from 24 to 38 cents unwashed, 40 to 60 washed; have mostly sold in Philadelphia. I shipped my wool, each fleece rolled up by itself. The combing or long wool is usually sold by itself, and brings the best price. Sheep are usually sold to those who ship, or graze, by the head from \$2 to \$3 per head. Lambs, about \$2 per head. Many of our sheep are taken off in the spring in thin condition and shipped to eastern counties, and there fattened for the Richmond, Baltimore and other markets. This operation keeps our stock of sheep far below what it should be. Our pasture lands afford the blue grass, red and white clover, orchard grass, evergreen, &c., all of which furnish good sheep grazing. They fatten better on the blue grass, and winter better on clover hay. Turnips and other root crops are not fed very extensively here to sheep, but they are very valuable to keep a flock in good, healthy condition. Large flocks become diseased, if kept too long or too much together. By separation, or removal to any other locality they sometimes make rapid and speedy improvement. They are well satisfied with short grass, but seem to want a wide range. I have concluded that it is the scent left upon the grass that makes them want to travel over so much territory. There are no woolen manufactories in this county, although we have great facilities to offer to capitalists who might wish to embark in that line. Dogs are very destructive, and heavy losses are annually suffered. I presume that it would take at least ten per cent. to cover the loss. I have a shepherd dog, but have to keep other dogs, more than necessary, to alarm and keep away the worthless, starving dogs that prowl over the country and usually kill the sheep. I believe very few diseases affect sheep here that will not give way by a change of the flock or the location, and that accounts for the fact that but few flocks have been bred to an extent to fully develop their merits. I believe the most profitable plan to manage a flock and to keep them in proper condition, produce the best quality of wool, and sheep for mutton, would be to get a flock of good Cotswold, and any other equally good breed, and continue to breed them together, supplying them with our blue grass in summer, and wintering on roots and clover hay, and selling the lambs for the early market, and such a number of the sheep as have reached five years of age, recruiting with the ewe lambs annually, none of which should be allowed to bring lambs until the second year. A system of this kind regularly adhered to, and proper attention, would, in my opinion, perpetuate the good condition of a flock for an indefinite period. Shelters should be provided for sheep, so that they could be protected from the rains, snows and storms of this country. Any breed of sheep that affords long, thin, stringy wool, so that the rains will penetrate to the body, and are exposed to the changing weather of our winters,

will soon become diseased and prove worthless. It requires a sheep that is coated with a thick, felty wool, that seems to be so compact as to protect the body, to live here without the benefit of good shelters. The diseases to which sheep are subject here, are what is termed "Rot"—a disease of the lungs—and another in which the intestines or bowels are constantly running off; some call it Scours. It is fatal, or at least many sheep have died from it during the last winter and spring. I know of no remedy that has ever accomplished much. For the other disease, the usual practice is to remove the diseased animals from the flock, and give tar, tar water, and resin freely. Some give pulverized wild cherry bark, all of which are said to be good remedies. Sulphur is used also, but my experience is, that it is not very beneficial. I lost more sheep from the Scours this last winter and spring than I have ever lost before, confined principally to my lambs of last year. Last year I clipped 280 sheep. I received in Philadelphia for nearly 1,200 pounds wool—the highest, 32 cents; the lowest, 24 cents. This year 220 clipped—shipped 907 pounds, contracted at 26½, besides each year we retained a considerable quantity for our home consumption. Our people here still manufacture much of their wool themselves, no woollen manufactories being very near us. I accidentally misplaced your circular, and the foregoing will not be such an answer as should have been returned. I cannot recollect precisely the enquiries it contained, as I gave it a hurried examination. I hope, however, if there are any facts here stated that will be of any advantage in the preparation of a work of so much value to our people and country, that you may be able to gather them from this hurried and imperfect statement.

I am, very respectfully,

JOHN DICKENSON.

WHITE POST, CLARKE CO., VA.

MR. EDITOR :

In reply to your inquiry as to "what part of the State offers the greatest inducements to persons desiring to raise sheep," I will reply that as good success is probably had with sheep in this county as any in the State; consequently you rarely find a farm, large or small, without its flock, or a farmer who does not admit that he makes more clear money from his sheep than from any other source.

The Shenandoah Valley railroad gives us the best facilities for getting our lambs, &c., to market. The crop of lambs, owing to the unprecedented winter, will not probably average over 80 per cent. of the ewes the past season. Lambs that will do to ship by the middle of May are bringing now from \$3.50 to \$4.00 per head, or 7 cents per pound gross. I will give the sales from two flocks that came under my observation last year: One farm, a flock of 285 ewes, lambs, and wool, sold to amount of \$1,300; the other farm, 68 ewes, sales to amount of \$350. In neither case was the best price obtained for lambs or wool.

I am happy to say we have a dog law, and losses from that quarter are fully provided for.

Respectfully,

DAVID MEADE.

TUNSTALL'S, NEW KENT COUNTY.

DR. POLLARD :

Dear Sir,—I shall answer your questions as they are put, after stating that my experience is a very limited one, not having raised sheep more than two years.

1st. I can only state what kind I am keeping. I have a mixture of Cotswold, Southdown and Shropshire. They gave me a fleece last spring of 6 pounds to the sheep.

2d. The sheep should be at least 12 months old before taking the buck, and I think the buck should be 18 months. The time of the year they should go together would, I think, depend upon whether your first object was to sell the lambs, or to raise them for mutton and wool; if to sell lambs, they should be put so as to come as soon after Christmas as possible; if later, I had rather wait a month or two later.

I have a small flock—only 20; they have improved much in both weight and quantity of wool. I first had sheep that were more Cotswold than anything else, though not pure; I have since crossed on Shropshire and Southdown. Will pass over the 5th.

Pasture—Wire grass and blue grass are our natural grasses; have no choice between them except that the blue grass runs through the winter; but while the wire grass is growing there is none better. Feed on corn, peas, and fodder.

My shelter is simply straw thrown upon rails on the north, northwest, and northeast side of the pen I feed them in.

I have not separated my combing from the short wool.

No factories in my county.

Sell in Richmond soon as fleeced.

Know nothing about their diseases.

Do not raise turnips for them; cows take all I can make.

Have not suffered from dogs as yet; keep no shepherd dog. I can form no idea of the loss by dogs in my county.

As I am going to turn my attention more to stock raising, hope to give you a more satisfactory account hereafter.

Yours, very respectfully,

J. C. GREGORY.

BUCKINGHAM, June 18, 1881.

DR. THOS. POLLARD,

Commissioner of Agriculture :

Dear Sir,—Your Circular No. 20 just to hand. I reply to your questions to the best of my ability, and most cheerfully; for I regard sheep-raising as of the first importance, and particularly suited to the worn out lands of Virginia; also, because I wish to aid you all that is in my poor power in your faithful and laborious efforts in behalf of the farmers.

A most singular and fatal disease broke out in my little flock of sheep last

winter, and as it could not be described in the short limits of answers to your inquiries, with your permission I will give you a short account and description of it: My flock of sheep were fat and healthy to the last of December; all at once, after a violent snow-storm, I found four of the finest young ewes down and helpless, and others took the same disease, and in the course of a month I lost eighteen of my finest young ewes. I tried every remedy I knew of or could hear of; not one ever recovered. The symptoms generally observed were, first, a loss of sense, if I may so express it—that is, they would stand in one place and not make any effort to get out of the way, not even noticing till you caught them; their eyes rolled back in the head, foaming at the mouth, nostrils, dry and hot; would eat a little if put at their mouths; with great thirst, and drawing back of the head (opisthotonos), and as the disease progressed a spasmodic jerking of the limbs and whole body occurred, some of them standing up until nearly dead. From all the indications I conclude that it is an affection of the brain, similar to “cerebro-spinal meningitis” in the human family. I could find nothing wrong about the bowels. They just seemed to live ’till they starved to death. Did you ever hear of such a disease among sheep?

Yours truly,

GEO. BOOKER.

Howardsville P. O., Albemarle, Va.

P. S. It was not ivy, I know, as they could get none.

G. B.

No doubt, in our opinion, Mr. Booker is right in his diagnosis of this disease. Some of the veterinary surgeons would call it tetanus, probably, but this is not epidemic or endemic, and is not attended with opisthotonos. Remedies he should have used—Blistering at the base of the brain and upper part of the spine, with gentle purgation with epsom salts.

BUCKINGHAM, VA., June 18, 1881.

Answers to Circular No. 20.

1st. I prefer the Cotswold, after having kept most of the other kinds. I consider them the most suitable and profitable, as they are the most prolific, hardy, grow larger, and yield more wool, and equally as good for mutton and early lambs.

2d. At eight or ten months; at same age; first September, if object is to sell early lambs; if to raise sheep is the object, first December, as the lambs coming late do much better, and there is no loss from storms.

3d. Cotswold.

4th. Forty-two Cotswold; wool doubled by cross.

5th. Generally get from 4 to 5½ pounds to the head; price varying from 25 to 40 cents; would put profits at 75 per cent.

6th. Thin, and land hilly with fresh water; blue grass and broom sedge, fodder or oats; in bad weather, corn or chop feed.

7th. Pen and shelter at night; run at large during day in open weather.

8th. Sell all together washed wool; say about one-third more for it.

9th. No factories (but should be).

10th. Richmond, when I send off; generally consumed by local demand; cannot say what the Richmond and Alleghany railroad will charge per head.

11th. As a general thing we have few or no diseases among sheep.

12th. Do not ; can do without such food, but greatly improved by it.

13th. Not recently ; keep no shepherd dogs ; look after them frequently ; can not say what the loss is to the county. I know a great many farmers will not undertake to keep sheep at all, because they say the sheep would be killed or stolen, and in this way both individuals and State lose a great source of income.

GEO. BOOKER.

JEFFRESS' STORE, NOTTOWAY COUNTY, VA., June 17, 1881.

DR. POLLARD :

I received your circular yesterday, and though busy, reply at once. I have been breeding sheep for more than forty-five years, beginning with natives and at first crossing them with pure Merino bucks, of good size and constitution, which first cross improved the wool and carcass more than any I have tried in my whole lifetime. From this time till our civil war I had no other breed than the Merino and its grades, getting occasionally the largest and strongest Merino buck I could find, and having a healthy, profitable flock doubling itself every year as long as it was kept down to about 35—the number my little farm of 200 acres could graze without stint the year through. After losing my Merinos by the war, I am now keeping Southdown grades of about the same size and healthiness, with wool rather longer, but not so fine as the Merinos. These two breeds are all I have tried, being convinced that larger sheep would not thrive on my moderate pastures.

2d. In reply to this, I would say I once tried separating the bucks from the ewes ; but with so little apparent benefit either to the bucks, the ewes, or as to the time for the lambs to be dropped, I discontinued it.

3d. This is answered by what I have already said, as I breed sheep conjointly, and not separately.

4th. My flock averages about 35, and the crosses made have been mentioned.

5th. My annual sales average about \$100 ; sheep and lambs selling for about \$2.50 each in the neighborhood, and wool for between 30 and 40 cents per pound, unwashed, in Philadelphia.

6th. The main indigenous grass of my pastures is white clover, which grows spontaneously wherever the land is not too poor, and salivates horses badly sometimes, as mine are now, and cows slightly (my milker says, I have never observed this latter myself), but sheep never. I also sow herds grass largely, which is fine for sheep, and resists better than any grass the hoof and the tooth except white clover and lespedeza, which seem to thrive under trampling and grazing. I generally feed sheep once a day in the month of January, February and March, giving spoiled and shattered corn, peas and pea-hulls, nice chaff and tail-ends of wheat, turnips, Irish potatoes, fodder and oats, as my flock readily eat any of these.

7th. I generally put my sheep in a tobacco barn bedded with oak leaves (even if the tobacco is hanging above them) every night, and turn them out in the morning.

8th. I separate no wool, but shear and fold up each fleece separately, tying each with a twine string to keep them separate, put in bags and send to W. C.

Houston, Jr., & Co., Philadelphia, unwashed, to be clasped and sold. Here is their report of wool sold last year :

83 lbs. medium (unwashed) at 38c. per lb.

28 lbs. $\frac{1}{4}$ blood (unwashed) at 34c. per lb.

15 lbs. medium combing (unwashed) at 38c. per lb.

9th. No woolen factories here.

10th. The wool is sold as reported. I sell lambs and mutton as I can, in the neighborhood, but sometimes as far as Amelia Courthouse, the purchaser sending for them.

11th. I know comparatively nothing about the diseases of sheep, having fortunately never had any diseased. With me they have been the healthiest of stock.

12th. I raise turnips in a small way, and Irish potatoes more largely, not specially for sheep, though I feed them on the refuse of these when occasion requires.

13th. I have suffered in my long experience in a small way from dogs, but in a far greater way from rogues; but in the last few years have had no annoyance from either. I keep two shepherd dogs and four bells for my small flock, and would not like to be without either, though I cannot trust the former out of my sight and hearing, as they will worry and kill sheep like other dogs. Keeping so much at home, my estimate of the annual county loss by dogs would be a vague guess. So much in reply to your circular.

With much respect, I remain your friend,

SHARPE CARTER.

PEDLAR MILLS, AMHERST Co., 21 July, 1881.

DR. THOMAS POLLARD :

Sir—I feel particular interest in the subject of sheep breeding now, being about to engage in the business quite extensively for so small a farmer; and though having been engaged in it for these 50 years, I feel that I am still a tyro. So, all that I say in regard to the matter, you, of course, will take “cum grano salis.”

1st. I should prefer Cotswold with $\frac{1}{4}$ Merino—because of the wool—the former being deficient in this regard.

2d. At 12 months. The buck should be at least 12 months old.

3d. As we keep them in this section for both wool and mutton, and can have reference to neither exclusively in the profit, therefore the combination as above indicated.

4th and 5th. Not answered, because too trifling to be noted.

6th. We are using clover and orchard grass at present, hoping, however, to get blue grass to take after a while. We feed on oats entirely.

7th. No protection for them. The sheep graze almost entirely, except in bitter weather, when they are fed, as I said, on sheaf oats.

8th. We make no separation of the wool. Get from 33 to 44 cents for it washed; 25 to 30 unwashed.

9th. There are no woolen factories in the county. I hope to see one established at “Pedlar Mills.” I have been urging it, but I think funds are needed.

10th. We sell our lambs and wool at Lynchburg, where we get \$2.50 and \$3.00 for the former, and, as I said above, from 33 to 44 cents for the latter.

11th. No experience in the diseases of sheep. That is to be avoided only by suffering but small flocks to run together, say 30 to 40, and changing the range frequently.

12th. Answered above.

13th. We have not recently; but in 20 years have had them killed out and scattered entirely twice. Can form no estimate of the loss from dogs in the county, because there are very few flocks in it.

Remarks.—Having my farm divided into five 30-acre fields, I would have 150 sheep divided into 3 flocks. I would have this small number, because I would consider one well kept would yield more profit than three badly kept, for according to the keep is the size of the fleece. I would have the buck put with the ewes 1st of November, so that the lambs would come in March, thereby getting the benefit of the grass. I would have the male lambs trimmed as soon as they fall, before they can get out of your way, because of the very superior growth. With the mother kept in good plight till yeaning time, they will be as large under this process in the month of May or first of June as if the lamb had come at Christmas. I would have at least 20 or 30 of these wethers, out of a flock of 150, to sell each year, which would bring at least \$8 or \$10. Old Dr. Morris of the "Green Springs" used to sell his, and the butchers would go for them at the latter price, \$10. I have known him to shear 12 and 14 pounds of wool from these wethers. Such sheep under such a process, I am convinced, must yield more profit, especially under the present system of labor, than the best tobacco at the highest prices. I would attempt to make no grain more than would suffice to keep the stock up. I am well persuaded that the vast importation of wool into the United States will be avoided, and that we shall soon become exporters of the article, if the attention of our people could be turned to its production—i. e., if they would be judicious in their selections and crosses, getting such a combination of breeds as would produce most mutton, and at the same time most wool.

If these crude observations should be of the least service in the preparation of the work you have in hand, I shall be much gratified, and consider myself as fully compensated for the time spent in the writing.

With very sincere regards, I am your obedient servant,

L. MINOR.

ACCOMACK COURTHOUSE, VA., June 20, 1881.

DR. THOS. POLLARD, *Richmond, Va.*:

Dear Sir,—In reply to Circular No. 20, I have to say:

1st. I have always had native county stock of sheep. I use a pure Southdown, and soon have a fine flock. The profit in sheep I have found in improved lambs to sell to breeders and early lambs for the market. I used a Shropshire buck on one-half and three-fourths bred Southdowns, but saw no advantage in it.

2d. I breed my ewe lambs the first year. The buck I should breed the first year to a few ewes. I have never done it, however, because I usually buy a buck that has been used a year or so.

3d. Southdowns suit our pastures best and produce the best lambs and mutton. Cotswolds are best for wool; at least, they have done well in this county.

4th. I have forty sheep.

5th. Clip averages five pounds of wool ; profits of which are on an average of one hundred per cent.

6th. Natural grasses and clover. We have wire grass, which is good feed for sheep. In winter feed black peas, turnips, corn and millet, alternating ; feed light.

7th. Shelter, an old stable.

8th. Sell my wool unwashed ; price this year, 26 cents per pound.

9th. There are no factories in this county.

10th. Sell wool in Baltimore ; lambs and mutton in the village ; go by the Eastern Shore Boat Company ; freight is cheap.

11th. All I know about the diseases of sheep amounts to nothing ; ninety-nine out of every hundred will die if sick much. My sheep are generally healthy. I have them dipped in a solution of dissolved carbolic soap and warm water and the lambs also. This is done at shearing time.

12th. Yes.

13th. Have not suffered from dogs. My dog was quite fierce after my sheep last fall when they were brought home to winter. Nothing would stop him. Being fond of the dog, I tried the following plan to break him from running after them : a rope six yards long was used, one end tied around the ram's neck and the other around the dog's. The dog was whipped, and he and the ram left together for about an hour ; occasionally the ram would butt the dog very severely. Since then the dog will not notice the sheep. Keep no shepherd dogs ; house my sheep in winter, and put them with cattle at other times.

14th. There are few sheep in the county. I have not heard of any being killed by dogs for two or three years.

Respectfully,

ORRIS A. BROWNE.

PIEDMONT, ALBEMARLE CO., June 25, 1881.

DR. THOS. POLLARD,

Commissioner of Agriculture :

Dear Sir—In reply to your Circular No. 20, I have had little experience with any except the common Western sheep. I have for some years kept a few of these. I prefer them because I think it best to change the flock frequently, and they can be obtained more readily than the improved breeds, and I find that a good picked Western ewe, well kept, will yield a fair crop of wool, and when let to a thoroughbred buck, will bring a good lamb for market. I make it a rule to cull my flock every year, selling the oldest and such as I do not desire to retain, thus keeping only good young ewes. I aim to sell all my lambs. None but the best thoroughbred buck should be kept. I have crossed my sheep with Cotswold bucks with good success, but I prefer to cross them with Shropshire bucks, since I find that the Shropshire cross fattens more readily and sells in market to better advantage. The *order* of the lambs in market is of more importance than the size.

2d. Two years. The 1st of September, if the object is to raise early lambs for market.

4th. I generally keep from 200 to 300 sheep, and find that there is a marked improvement in the Western sheep when brought here and treated well.

5th. As a general thing, I raise a lamb to the ewe, and the sheep average about four pounds of wool. The lambs sell at an average price of about three (\$3) dollars, and the wool averages about thirty (30) cents to the pound. A fair Western ewe when bought costs about \$2.75.

6th. I sow orchard grass and clovers, but I prefer a good sod for sheep; a blue grass sod preferable. In the winter I give the sheep about a gill of corn per day with hay, if I have it to spare; if not, I feed them on corn-fodder; meal or a mixture of mill offal would be better than corn.

7th. I keep ample shelters for my sheep, to which they have access, but are not confined to them. At lambing time, or as fast as the lambs come, I separate them with their mothers from the remainder of the flock, turning them on a smaller grass lot, while they are weak and feeble. I aim to turn out a grass field in the fall, which I do not graze, but save for the ewes when they lamb. The lambs do much better when the ewes have access to good grass. The ewes need green food, and will not give milk plentifully upon dry food. Hence, while I have not yet tried it, I am confident that "Ensilage" will prove beneficial for this purpose.

8th. Have never separated or classed my wool, nor have I ever washed it.

9th. One. The Charlottesville Woolen Mills, located in this county, near Charlottesville.

10th. I have shipped my lambs sometimes to New York and sometimes to Baltimore, and have sold my wool in Baltimore and in Philadelphia, but if I can get a fair price at home I prefer to sell to parties here who make it a business to deal in stock. The cost on a lamb from here to Baltimore is about 25 cents, and to New York about 80 cents.

11th. Have generally been quite fortunate with my sheep, and hence have had little occasion to study the diseases and their remedies. Last winter, however, I lost a number of sheep, owing, I think, to the extreme cold, together with the change from green to dry food. Ensilage or mill offal, I doubt not, would have saved my sheep.

12th. I raise no turnips or other roots. I intend to try Ensilage.

13th. Have suffered from dogs to some extent. I keep shepherd dogs, and use bells—about one dozen to the hundred sheep—which, I think, affords some protection against rogues as well as dogs. The loss from dogs for the county is, I know, very heavy, but I do not think that I can approximate it.

Yours, very respectfully,

JOHN W. GOSS, JR.

HARRISONBURG, VA., July 9th, 1881.

Mr. THOMAS POLLARD:

Dear Sir,—I will give you my limited experience in sheep raising with pleasure. I only have a small lot of sheep.

I bought three years ago a small lot of "Silver Fleece Cotswold" sheep from Kentucky, and a few of the best and purest Southdown that I could get. Both breeds full blooded. The first clip of the Silver Fleece Cotswold averaged 12½ pounds to the fleece from ewes suckling lambs. I clipped from one ewe that had a lamb 15 pounds. The wool is about 13 inches long, very fine and nice. The same season I clipped from my Southdown sheep an average of 8 pounds to the fleece.

I sold my Cotswold wool that season at 80 cents per pound, and my Southdown wool at 40 cents per pound. All the wool was unwashed. The next season wool was not so high. I only got 60 cents for my Cotswold washed, and 40 for my Southdown. Last season I sold my Cotswold at 50 cents in the dirt, and my Southdown at 30 cents.

The average weight of the Cotswold last year was 11 pounds to the fleece, and Southdown 7 pounds to the fleece. I sold two of the Silver Fleece Cotswold buck lambs at eight months old that weighed 145 pounds apiece—my Southdown lambs of the same age averaged about 115 pounds. I have none of the old herd of Cotswold sheep. I only weighed one of my Silver Fleece Cotswold ewes this spring. She weighed 160 pounds after shearing. The fleece weighed 11 pounds. I have not sold my wool this season.

For wool and mutton both I prefer to cross the Silver Fleece Cotswold with the Southdown. For mutton alone I think the Silver Fleece Cotswold superior to any of the other breeds that I know anything about. First, they fatten easily and rapidly, have fine large carcasses, and the flavor of the mutton is *delicious*. As to lambs, they seldom have more than one, and that is enough for the lamb and ewe both to do well. The Southdown ewes frequently have two lambs. If there is any difference in the fattening qualities, it is in favor of the Cotswold. I can sell my Cotswold bucks easier and faster than the Southdown, and never sell them for breeding for *less* than twice as much as I can get for a Southdown buck. I have never sold a buck lamb of my Cotswold for less than \$10 and seldom for less than \$15.

I only shelter my sheep in stormy weather. When they can get to the sod, I don't feed any grain. When I feed grain I mix oats and corn, and feed a pint a day apiece to my stock sheep. I have not fattened many lots of sheep on grain. My mode is fattening on grass, as a general rule, as that pays me best. I prefer nice clover hay for them to any other long food—next to that, bright sheaf oats. If I were feeding with a view of marketing off of grain, I would prefer nice clover hay in the morning with a pint of corn to the head, and nice bright sheaf oats at night, in such quantity as they would eat up well. The only lot of sheep that I fattened on grain paid me 33½ per cent. on the investment. My Cotswold sheep have paid me thus far about 40 per cent. on the investment, and that with so *little* grain that I did not take it into the account.

I always assort my wool, and keep the different grades to themselves, taking all the dirty tags off, so there is none of the refuse wool left with the fleece. Generally ship my wool, but sometimes sell at home. Washed wool sells for from 25 to 30 cents more per pound if nicely washed. If badly done, it sells at about the same price. I am speaking of tub-washed, not washed on the sheep's back.

There is a woolen factory at Bridgewater, and I think there is one at Port Republic in this county.

I generally sell my wool in June in Philadelphia, but prefer selling at home when I can get a fair price. My lambs I sell at home to dealers, and I can't give the cost of shipping. It costs me about 15 cents per pound to market my wool in Philadelphia, all told.

I have never had any disease among my sheep, and consequently know nothing about them or the remedies. I have frequently suffered from dogs, but have not lost a sheep by them since I put a considerable lot of bells on them. I run them with cattle generally, as I think they are a great protection to sheep. I do not

keep shepherd dogs. I do not know the exact number killed in the county annually by dogs, but it would amount to several hundred, I think; and the loss to the county by dogs is probably not less than \$1,000 a year in killed without computing the injury done to the rest of the sheep by fright and severe running. They seldom do any good after they have been run by dogs.

I give my sheep no roots of any kind, and never fed a turnip in my life. I salt regularly once a week, mixing the salt generally with wood ashes. Sprinkle the salt around, never throw it down in a pile, as sprinkling prevents them from eating too fast.

I don't think a ewe ought to go to the buck until she is a year old. A buck had better be kept from ewes until he is two years old, as his lambs will be stronger and better. It is very important to keep sheep dry. The buck should go to the ewes in September. Ewes should be *well fed and well protected during lambing time*. There should be at least a buck to every fifty ewes, and not over one hundred ewes in a flock, and it would be better not to put over fifty ewes in a flock, and put two bucks with every fifty ewes. I think you would get more lambs and stronger and better ones managed in that way than in larger flocks and fewer bucks.

If this article benefits my fellow-farmers, I shall be gratified and repaid for my trouble in writing it.

Very respectfully yours,

W. J. CHRISMAN.

JOHNSONTOWN, NORTHAMPTON, VA., June 20, 1881.

DEAR SIR:

I have your Circular No. 20, and in reply—

1st. I have taken the native sheep and crossed with a Cotswold buck.

2d and 3d. This is the only cross that I have tried.

3d and 2d. I let the buck run with the flock, and many of the yearling lambs have lambs the next spring after they were dropped.

4th. In 1879 I had obtained a flock of 47 ewes and one Cotswold buck. The ewes were nearly all one-half and three-quarter Cotswolds, and raised by myself. I have buck lambs at five months old to weigh 94 pounds, without any feed more than they got themselves; and my three-fourth ewes sheared about 6 pounds of wool. On October 23d of that year we had a violent storm in the night, and the tide rose nine feet above ordinary high water, and drowned 36 of my 48, including my Cotswold buck.

5th. My sales of wool have been from \$20 to \$55. The lambs I sold here at from \$3 to \$5, and mutton sheep about \$3. The profits were about 25 per cent. until the loss in 1879.

6th. My pasture is salt, and half salt marsh and upland woods. The sheep are very fond of what is here called myrtle (spice wood), which grows abundantly in the woods, and keep fat on it in winter. I do not feed my sheep at all, except in very cold weather they will come up to the pound sometimes when they are hungry, and I give them some corn.

7th. They get no protection except in the pine thickets, and do better than when yarded here.

8th. Mine are all alike, and we do not wash our wool.

9th. No factories of any kind.

10th. Sell the wool in Baltimore, lambs here; the wool in May or June, and lambs in August or September.

11th. We have no diseases except occasionally grubbs in the head, for which we have no remedy, and sometime scours, when we give one teaspoonful of paregoric twice a day until relieved.

12th. Sheep here do not seem to care for turnips, nor do they care for fodder.

13th. Not much lately, as I have killed most of the dogs around me with strychnine and buckshot. I do not think the loss in the county is over 3 per cent. from dogs, but there are now few sheep kept. Up to 1879 the interest in sheep was increasing very fast. Several of the Sea Islands have flocks of 350 to 500. The flood drowned nearly all of them, and discouraged every one. Then, since '79 we have had three successive years of drouth up to this time, reducing the pastures to nothing, and prevented raising feed for the sheep to supplement the pastures. I sowed "German Millett" on purpose for them the past two years, and it came to nothing. Last winter the few who had sheep lost about one-half. Some who got them up and fed them corn every night doing no better than those who let them take their chance. After '79 I bought some sheep in Baltimore and here. I was cheated in the lot from Baltimore; those I got here doing pretty well under the circumstances, but from the losses they have not been profitable since then, owing to the drouths. I loose some lambs from foxes, and now and then one by eagles. I poison the foxes by putting strychnine in eggs and setting them about, and occasionally shoot an eagle with a rifle. I believe I have given you all the information that I have. I shall keep on trying, and perhaps will have better success in the future. But these drouths are terrible. In May, 1879, we had 0.50 inches of rain; in May, 1880, 1.45 inches, but it all came on and after the 22d. This year we had 0.70 inches, and most of it was on the 22d. So far this month 1.45 inches, all on the 1st, 2d, 3d and 4th; in addition, we had 0.20 inches the 14th, none since. We can work our corn, but that is about all.

Truly,

C. R. MOORE.

MATHEWS COUNTY, VA., July 3, 1881.

DEAR SIR :

Your circular received, and I will give you my limited experience regarding sheep with pleasure.

1st. I prefer the Cotswolds crossed with the Southdown, and am keeping this cross and find them profitable.

2d. A ewe should not go to the buck until 18 or 20 months old; buck the same age, and to go together first of September.

3d. I prefer the above cross.

4th. I keep from 25 to 30 ewes, and have improved them nearly double, but have taken good care of them.

5th. My sales are often 100 per cent.

6th. My pasture lands are level, and I prefer short grass and white clover, and feed enough to keep them fat.

7th. Keep them comfortable, but not too close, and let them graze on wheat, rye, and oats when the land is hard, and let them have plenty of long food, and after they have lambs give the ewes some grain and the lambs meal.

8th. I do not separate my wool; I send to market unwashed. Last year I got 33 cents, and only 27½ cents this year.

9th. No factories in my county.

10th. I send my lambs and wool to Baltimore in May and June, and mutton in February; send by steamer, and pay 30 cents on lambs and mutton, and ½ cent per pound on wool.

11th. I know nothing about diseases of sheep. We never could do anything for them.

12th. I raise turnips and all the roots I can.

13th. I have not suffered from dogs. I pen my sheep with my cattle. I think 8 or 10 percent will cover the loss from dogs.

I think the great trouble with many farmers is, they keep too many sheep and think they require no feeding and little attention.

Yours respectfully,

WM. LANE.

SINKING CREEK, CRAIG COUNTY, VA., 22d June, 1881.

THOMAS POLLARD, ESQ. :

Dear Sir,—In regard to your circular regarding sheep, which has been addressed to me, I beg leave to submit the following, viz :

That I consider the Southdown or the Shropshiredown as the best and hardiest breed of sheep we can keep. I have kept the Cotswold, but consider them less hardy and they are not so solid as the Downs—that is, they will not put on the weight of mutton to their size that the Downs will. My flock now consists of about three-fourths part Downs, having crossed the Cotswold ewes with Southdown and Shropshire rams, which makes a very good cross, giving weight to the sheep, and though it shortens the wool a little, it imparts fineness to it. My flock in summer usually numbers about 500 including lambs, which I reduce in winter by selling of the old ewes and three-year old mothers to about the number of my lambs, which usually averages about 150, leaving 350 or so to keep over winter.

The rams should never be under 18 months old when put to the ewes, which should not be under that age either. They should be put together about the middle of September, when they will lamb about the middle of February. I do not sell any lambs for the butcher (being rather out of the way), but keep them and dispose of the older sheep. I believe the Oxforddown on the whole the best sheep for mutton, wool and lambs, though the Southdown and Shropshire are not far behind; but I prefer the cross for the main flock as stated before, it being more hardy than breeding the pure bred.

My sheep average about 4 pounds of washed wool—that is, by washing the sheep a few days before shearing—and for the last five or six years the main portion of my clip has averaged about 50 cents a pound in Boston, and it costs about 1½ cents a pound to send it from here. I always take all the belly pieces and skirtings about the legs off and put it by itself, which is all the classing I make.

As for the mutton sheep I sell, they bring me \$4.25 a head in the month of August, taking delivery here.

My pasture land is almost all hilly, and well divided, so as to make frequent changes of ground, and sufficient timber scattered throughout it, which secures shade from the heat of the sun. In sowing grass I usually sow timothy and orchard grass, but in time they disappear before the sheep and finer grasses come, such as blue grass. In winter time I separate the young sheep from the old, and give them one side of the barn, the ewes the other side, so that they never mix. The wethers I keep separate again by themselves. The sheep get access to the whole ground of the barn and sheds round it, in which there are troughs fixed for feeding in rough weather, and it is well and frequently bedded with straw. In fine weather I always feed in the lot adjoining the troughs. I give the young sheep—i. e., the lambs—a little oats and corn every day, commencing at weaning time in August and continuing it until the end of February or so, together with hay, which I cut up and put in their troughs. The ewes merely get cut hay with about an ear of corn apiece until before lambing, and as I separate them on lambing, I increase the quantity, so as to produce a good flow of milk. The wethers usually only get cut hay until the month of February, when I give them a little corn as well, which puts them in good order by the time the grass comes. I cut all the hay up by horse power. After lambing, when the lambs commence to eat, I form an enclosure of hurdles with troughs inside, and the spaces in the hurdles so arranged that the lambs can get in, but not the ewes, and in the troughs I place a little meal, which the lambs soon learn to lick, and which is a great benefit to them.

I do not raise turnips or any other roots for them, as the climate is too hot and dry for the successful raising of turnips.

As to the diseases of the sheep, we are particularly free, and when disease does come the cures are very uncertain. The main point is to keep them healthy by never keeping old sheep, changing the rams frequently, giving them frequent changes of pasture, with shade from the hot sun, free access to good shelter, with plenty of fresh bedding in winter and good feed, keeping them clean in every way, and freeing them from all ticks after shearing, which can be done by simply dipping the lambs, as they will drop off the shorn sheep when the hot sun strikes them.

We are particularly exempt from any sheep-killing dogs, I having only lost two sheep in eight years. I never hear of any dogs killing sheep hereabouts. I do not keep any shepherd dog, nor do I use any means for protecting them from dogs. They lie out in the fields all night.

I never sell any unwashed wool, and there are no woollen factories in the county, though close adjoining.

I believe the above, though not detailed separately, contains most of the information asked, which I hope will prove of use to you, and should you wish any further information, I will give what I can.

I remain yours truly,

T. B. NIELSON.

EDGE HILL, VA., June 22, 1831.

DR. T. POLLARD,
Commissioner Agriculture :

Dear Sir,—Your Circular No. 20, in regard to sheep, is to hand. Owing to the poor protection given by our Legislature I have been afraid to venture any outlay in sheep further than to raise a few for table and to afford wool for family use. I believe them to be the most profitable stock we have if protected against the rogues and half-starved curs.

1st. I only keep from 15 to 50 head, a cross of Southdown and Cotswold. I would prefer Southdown to all others, but they are too hairy on the back part of leg and sometimes get lowsy there. If crossed upon the Leicester with a view to get the clean leg, with the easy keep and thrift of Southdown, both breeds would be improved.

2d. Have never experienced—usually allowing their own way.

3d. Southdown for mutton; Cotswold for wool and lambs.

4th. As low as 15 and high as 50; Southdown and Cotswold; but little improvement.

5th. Twenty-five to 30 cents for wool; \$2.50 to \$3 for lambs; but we sell very few; eat the lambs, and trade wool for labor, &c.

6th. High and rolling; native grasses, with clover.

7th. I usually shelter at night, and give a little shelled corn night and morning during winter. My shelter is an open shed, but I believe they do better with access to a pine thicket and no other shelter, if fed a little corn along the ground.

8th. Never separate the wool; washed wool about 5 to 10 cents higher than unwashed.

9th. No.

10th. Lynchburg, in April and May; cost of transportation, 20 cents for lambs, and 10 cents per hundred for wool.

11th. Comparatively nothing.

12th. To a very limited extent.

13th. Have not suffered from dogs so far, which I attribute to bells and frequent housing or penning with cows, but am in continual dread. Do not keep shepherd dogs. Any estimate of loss for county would be guess work, as I go about but little and have no data. In the census report, which I took for this district, I found but very few sheep kept—not 5 when there should be 1,000. The few who have ventured have lost so heavily by dogs that the many are deterred. Money must be abundant before one would venture \$50 for an improved ram, and \$10 to \$25 each for ewes, probably to have all in one night killed.

Very respectfully yours,

S. B. WALKER.

SALTVILLE, VA., June 18, 1831.

THOS. POLLARD, ESQ.,
Commissioner of Agriculture, Richmond, Va. :

Dear Sir,—I will answer the questions contained in your circular in a general way, as they are given by numbers.

1st. Southdowns.

2d. I breed my lambs at about nine months old, but I believe it would be better to keep them from bucks until they are twenty months old.

3d. Southdowns.

4th. Thirty-one hundred. I have made one Leicester cross and two Cotswold, but prefer Southdown.

5th. My sales of wool amount to \$5,100. Sell no lambs. Sell wethers at two and three years old at 6 cents gross at home.

6th. Blue grass and orchard grass; prefer blue grass. Feed shelled corn in winter. They run in pasture during the entire winter.

7th. Little or no shelter. Our pastures are on hills, and they get on the warm sides during storms.

8th. Do not separate combing from short wool. Sell wool unwashed from 22 to 28 cents per pound.

9th. Yes; woolen factory at Holston Mills, Abingdon, Va., and Bristol, Tenn.

10th. Sell wool as soon as clipped at home; also sell mutton at home.

11th. Sheep have no diseases in this part of the State, and live to good old age, unless slaughtered or sold for mutton.

12th. Raise no turnips or roots.

13th. Have not suffered any from dogs for past five years. Do not keep shepherd dogs. Had some of them some years ago; they killed some sheep, and I had the dogs killed. The loss of sheep from dogs in my county is very light; does not exceed one-fourth of one per cent. of the number of sheep.

Yours truly,

GEO. W. PALMER.

LIBERTY, BEDFORD, VA., June 18, 1881.

DR. POLLARD:

Dear Sir,—In reply to Circular No. 20, I will say I have not attempted to raise sheep for eleven years, but if anything I may say will help you, I give it, and will request a copy of your work if convenient. My ideas are from my own observations and from the experience of others in this section (near the Peaks of Otter).

1st. Southdown and Cotswold.

2d. Ewes generally first year, but for perfection 18 months, and with rams a small number may be served at 8 months; September and October.

3d. This same cross.

6th. Generally rough, hilly fields. We have blue or wire-grass sod; hay or fodder in snowy weather.

7th. Generally no protection; some few have sheds with a warm exposure.

8th. No, except taking out the very worst. Prices, about 30 cents unwashed.

10th. Lynchburg and Bonsacks; butchers of Lynchburg come and buy lambs and muttons as it suits them. At times a buyer or a farmer ships a car-load to Baltimore; freight on wool, 10 cents per 100 pounds; can't tell the amount of freight on the cars. Drive to Lynchburg, 25 miles.

13th. Yes, years ago, and neighbors suffer now; no shepherd dogs. Have no idea of the loss to the county as our papers never report, and I do not bother around the courthouse. Our county pays the owner for the sheep killed by a

"dog law" imposing a tax on dogs, which is appropriated to pay losses of sheep by dogs.

I am much interested in this subject; am thinking of attempting the experiment of renovating a poor farm by the help of sheep. The answers of your correspondents will help much when you can collect them and put them in form.

Respectfully,

J. W. MOORMAN.

We give the following on the other side of the question of the profits of sheep-raising—the only unfavorable reply we have received. We will say that we have eaten as fine mutton in Amelia as is to be found in almost any county in the State :

OSMIRE, AMELIA, June 18, 1881.

DEAR DOCTOR :

I am sorry to be unable to furnish any useful information upon the matter embraced in Circular No. 20.

The uniform results of efforts made by those similarly situated have always deterred me from attempting to derive a revenue from sheep husbandry, and my flock has therefore consisted only of the few necessary for family use.

Negroes and their dogs present a fatal difficulty to sheep-raising in this region of country, and even did not such exist, others would probably be found in the soil or climate, or in both. Certainly nobody has yet succeeded in even maintaining alive any considerable flock of sheep, and yet the attempt has been made by gentlemen of high eminence in other walks of agriculture. The late General Cocke tried it upon his fine "Belle-Mead" estate—buying the sheep, importing the Scotchman with his dogs—and had to abandon the enterprise as impracticable. The late venerated Wm. Old, of Powhatan, persisted in the effort for years, bringing it, as he did everything else, to its "logical conclusion." That conclusion was *failure*. Mr. Lewis E. Harvie tried it with equally disastrous results. In fact, it seems to me that to keep a flock sufficiently large for material results would involve an expenditure larger than any promised profit can justify.

Giving little attention to the subject, I am unprepared to furnish either facts or theories of any service to you, and write merely as a mark of respect to regret that disability.

Truly yours,

MONRO BANISTER.

It will not be, we think, inappropriate to introduce here the following communication addressed to General Le Duc, United States Commissioner of Agriculture, for incorporation into this report, on the "International Exhibition of Sheep, Wool," &c., held in Philadelphia last September (now in press, we believe), though it may be at the risk of some repetition of what has already been presented :

THE ADVANTAGES OF VIRGINIA FOR SHEEP-BREEDING AND THE BREEDS BEST ADAPTED TO THE STATE.

HON. GEN. WM. G. LE DUC,

Commissioner of Agriculture of the United States :

My Dear Sir,—In compliance with my promise given you in Philadelphia at the international exhibition of sheep, wool, &c., to report to you on the subject which heads this communication (as I was not then prepared to give satisfactory information on this important industry in reference to Virginia), I will endeavor now to say something for publication in your forthcoming report, though I am conscious it will be imperfect. I have not had time to confer with our prominent sheep-breeders with the view of getting the results of their observation and experience of the advantages Virginia possesses for sheep-raising, and of the breeds best adapted to the State, though I have written to some of them on the subject. I may say that no one who has attempted sheep-raising in Virginia with any system, or advantages, or industry, has failed to find it profitable and remunerative. Ours is a "climate of means," the State being situated between 36°31' and 39°27' N., corresponding in latitude though not in climate to Southern Europe and Central Asia. The climate is quite similar to that of Central France, Saxony and Hungary. In the latter country there are districts having 5,000 to 6,000 sheep per square mile, the whole country having in 1870 15,077,000 sheep, this region being the great "sheep-walk" of Europe. This State is removed from the frozen climate of the North, and the enervating temperature of our southern neighbors, and for the health of its inhabitants is not surpassed by any State in the Union. This, while not having a direct bearing on sheep-breeding, has an indirect one, as the health of those who tend, as well as those who own sheep, is not an unimportant point; for a few day's sickness of attendants, and consequent neglect of a flock, might result disastrously.

The instances of profit from sheep-raising in Virginia are numerous, and it is a matter of surprise and regret to us that sheep are not more numerously bred. Several causes operate to prevent the more general and extensive prosecution of this industry. The want of fences and the means to build them, want of knowledge and appreciation of the fact that sheep-raising is very profitable and a great means of renovating lands, indisposition to undertake the trouble of stock-raising of any kind, and last, but not least, the destruction and worrying of flocks by the universally diffused and irrepressible and popular "dog," are the prominent causes. This last evil seems destined to exist as long as the dog interest can outvote the sheep interest. But if every farmer would raise sheep, as every farmer should do, and if then the farmers were to bring to bear their influence in a decided, peremptory manner on their legislators, the evil might be remedied. In some of our counties their representatives in the Legislature have, through the urgent wishes of their influential constituents, procured the enactment of a law to tax dogs and devote the proceeds to the payment for sheep destroyed by dogs. In one large county (Bedford) and perhaps in others this law has been successful, and the tax thus raised has been more than sufficient to pay for sheep destroyed by dogs. This, however, does not remedy the whole evil, as flocks are sometimes almost ruined ("demoralized") by the worry and fright of the attacking dogs, and in some cases, no doubt, the farmers fail to replace the sheep that are killed.

We have before us a recent letter from Mr. J. Wearmouth, superintendent of the experimental farm of the "University of Virginia," a native of England and a gentleman recognized as having an extensive knowledge of sheep-breeding, in which he says: "I do not hesitate to affirm, if sheep have proper care and receive personal attention, 100 per cent. can be made on them." He was having more particular reference to the section in which he is living. General G. S. Meem, of Shenandoah, Va., sometime since gave me a statement of his breeding a flock of sheep and his profits on them. He says: "In the fall of 1875 I purchased a flock of good native ewes, and two thoroughbred Cotswold bucks. Below is a statement of the account:

Dr.

1875.	
Oct'r 1st. 105 ewes at \$4 each.....	\$420 00
2 thoroughbred Cotswold bucks.....	75 00
1877.	
Oct'r 1st. Two years interest.....	59 80
	\$554 80

Cr.

By 51 yearling wethers, weighing now 125 pounds, supposed to be worth \$10 each (soon to be sold).....	\$510 00
By 68 yearling ewes, now being bred to a thoroughbred buck,	544 00
By 112 lambs of this year, sold at \$4 each.....	448 00
By 892 pounds combing wool (in the dirt), from 119 yearlings, sold last year at 42 cents per pound.....	356 00
By 750 pounds of wool sold from two years shearing of common ewes, 25 cents.....	187 00
1877.	
Sept'r 1. 90 ewes (all left of the above flock), sold at \$3.50 each.....	315 00
By 2 thorough bucks, after two years use.....	75 00
	\$2,435 00

Leaving a profit of \$1,880.20 in two years upon an investment of \$554.80. * * The estimate upon the yearlings is not considered too high by those who have seen them; their fleeces averaged $7\frac{1}{2}$ pounds of combing wool last spring, netting \$3 apiece, while the fleeces of their mothers only brought one dollar in the same market, and the two flocks were treated alike, showing the value of the first cross from a thoroughbred buck. Everything the sheep fed on was grown on the farm; grass, principally, with very little grain and hay in winter." General Meem observes, "Being familiar with every part of Virginia, I know no part where wool and mutton cannot be raised most profitably if the proper care and attention is given the flock. In Tidewater Virginia the fleece will not be so heavy as in the mountainous regions, but then that is more than equalled by the comparatively mild winter in that section, and the less winter's food required."

Our mild winters in Virginia are much in favor of the profitableness of sheep-raising on account of the little food required to support them. This is particularly the case as regards the winter temperature of Middle and Tidewater Vir-

ginia. These do not produce the natural grasses in such perfection as do the Mountain, the Piedmont, and the Valley; but we have seen as fine mutton raised in Middle Virginia—in Louisa and other counties of that section, and in Amelia and other counties of the “southside” (of James river)—as will satisfy the most epicurean taste. Clover, orchard grass and red-top thrive in all Eastern Virginia by some care and attention, the marl of Tidewater being particularly promotive of the growth of clover. In these sections a sod can be formed of orchard grass, which, by occasional top-dressings of manures and commercial fertilizers, can be made to last for years, and in most of the winters afford good grazing for sheep; and rye, seeded last of August and first of September, affords good grazing all the winter for sheep, except when occasionally covered with snow. This rye, after winter grazing, can be suffered to grow up, and by turning under will be adding every year to the fertility of the land, for the seeding can be repeated every August and the process kept up. Our winter oats, though not affording so good grazing as rye, grow through the winter, and may be used in the same way, except that the crop is so valuable that it will be best to cut it off for feed when matured, and in a week or so plow the land up, which will be reseeded by the shattered oats, and by the use of some fertilizer the fertility of the land and the production of the oats can be maintained indefinitely. The Piedmont, Valley and mountain portions of Virginia are *par excellence* grass regions; “blue grass” and other grasses spring up spontaneously, and afford excellent grazing for sheep.

In all sections of the State the health of sheep is excellent. For three years we have sent our circulars to obtain information about crops and stocks, always making enquiries about the condition and health of stock. During this time we have received no reports of any disease among our sheep.

Our correspondents have frequently taken occasion to express their opinions of the profit of sheep-breeding, and the remark has often been made by them that if properly conducted it will pay 100 per cent.

As regards our climate, to be more specific, we find from meteorological tables prepared by the “Smithsonian Institute,” the mean temperature in 1869-70 for autumn was $54^{\circ} 1'$, and winter $38^{\circ} 5'$; and in 1870-71 the mean temperature for spring was $54^{\circ} 2'$; for summer, $73^{\circ} 5'$; for autumn, $57^{\circ} 8'$, and for winter, $36^{\circ} 5'$, the annual mean being for the two years $55^{\circ} 9'$ —the highest temperature for the two years being 93° in June, and the lowest being 8° in February, 1870, and 8° in December, 1871. It is rare that we have the temperature higher in summer than 90° , and in winter than 5° or 8° , rarely reaching zero. The *Gazette*, of Virginia, published by Martin, puts the mean climate of Virginia 55° . Mr. Jefferson, by observations made at Williamsburg from 1772 to 1777, found the mean temperature to be 60° , the highest mean temperature for any month being $81\frac{1}{2}^{\circ}$ in August, and the lowest mean temperature for any month being $38\frac{1}{2}^{\circ}$ for January.

Captain John Smith, in writing of Virginia, says: “The chief of winter is one-half December, January and February, and one-half March; the cold is extreme sharp, but here the proverb is true that no *extreme long continueth*—Heaven and earth never agreed better to frame a place for man’s habitation.”

While Middle and Tidewater are not strictly what would be classed as grass regions, the natural grasses, white clover, green sward, and wire grass (*cynodon dactylon*, the same as the Bermuda grass, considered so valuable for sheep in

States south of us*), crab grass, &c., are sufficient in many places for pasturing large flocks of sheep. The wire grass is very general, and very valuable, as it stands heat admirably and never fails by reason of drought. The Bermuda grass is almost the only grass that will stand the heat and long summers of the Gulf States. The Crab grass, *Elusine Indica* (Flint), generally covers our fields after oats and wheat, and particularly after corn when it ceases to be worked, and affords good grazing. We think it is unknown in the Northern States. Mr. Wm. Holman, an enterprising and intelligent farmer of Cumberland county, Virginia, informs us that in his county he has more than once seen fields in that county well set with clover, in a natural way, without being seeded.

The kind of sheep best suited for Virginia depends, in a measure, upon the different sections of the State. In Eastern Virginia the farmers think Southdown for mutton, and Cotswold, or a cross of the two, for early lambs, pay best. The easy access to the cities of Virginia and to the northern markets enable the farmers of this section to get good prices for early lambs, and the climate, with our moderate winters, brings lambs forward very early in the spring. In the Valley and in Piedmont Virginia, where the lands are fertile and the grass luxuriant, the Southdown and Cotswold can be profitably raised for mutton, lambs, and for wool. In the mountain regions we think the Merino, if properly cared for, will be the best and most profitable sheep to raise. These three varieties are the only ones which have engaged the attention of our farmers to any extent. The Oxforddowns may be found to surpass the Southdowns, and we advise their trial. They were the finest sheep on exhibition in Philadelphia at the late international show of sheep, &c. They have a large frame; the famous imported Oxforddown ram "Freeland" (Mr. T. S. Cooper), weighing at the time of the centennial (in 1876) 425 pounds; they are of strong constitution, and are said to bear close quarters and confinement; their mutton is superior, their bodies symmetrical and well covered with wool, which partakes more of the long wool character, and is superior to that of the Southdown. The Leicester is another variety which should be raised in Virginia. The climate of the Northern States is said to be too cold generally for the Leicester, and therefore the hardier Cotswold are preferred; but the climate of Virginia would suit them, for in Ohio Mr. Hayes (Sheep Husbandry for the South) says Leicester wool has been produced equal to the best English. The wool of the Cotswold is too coarse for many worsted fabrics, and it has neither the fineness or the lustre of the Leicester. Greatly increased fineness in the Cotswold wool may be produced by even a moderate infusion of Merino blood, but the very important quality of lustre—such as is demanded for the brilliant fabrics—can be imparted only by the Leicester or Lincoln blood. Besides, Mr. Hayes says the Leicester is most valuable for crossing of all the mutton sheep, imparting its precocity, and its capacity of fattening in one year, and of attaining its growth in two years, thus imparting its mutton-producing quality to all other breeds. It requires good pasturage in small space, and mild climate. Dr. Wm. Williams, of Tennessee, says for general purposes in that State the Leicester is unsurpassed by any other breed; that compared with different breeds of fine wool sheep they are larger and yield more wool, which is worth more per pound; that they have good constitutions, fatten as well as

* This has been denied, but we think we have established their identity by procuring samples of each and sending them to the botanist of the United States Agricultural Department, who pronounced them the same.

Southdowns, have a heavier carcass, a heavier fleece, also worth more per pound; that the ewes are good breeders and nurses, often producing twins, which grow off as well as single lambs, and are much sought for by butchers. (Sheep Husbandry, by J. B. Killebrew, Commissioner Agriculture, Tennessee.)

Mr. Hayes advises the author of "Electoral Wools," called in Germany "Noble Wools." These were produced by the old Saxon sheep (which, he says, were tried in Maine, but the climate proved too cold for them), and at present by the Silesian sheep of the same, or very similar race. These sheep have succeeded in West Virginia, and there is no reason why they should not be equally successful in Virginia. Mr. Hayes quotes from Mr. Whitham, of West Virginia, a practical wool-grower and wool-dealer, who furnished him a long communication on the subject. After mentioning several others who raise this breed, and their success, he says: Mr. Ninian Beall, of Ohio county, West Virginia, has a flock of 500, which may be considered, with that of two or three others, the cream of the once famous Saxony flocks of West Virginia. He is now breeding from Silesian rams, among them a ram, "Beecher," purchased at the Centennial, which shears 11 pounds of unwashed wool, very compact, yet short in staple. His flock will average from 3 to 3½ pounds, and he gets for it from 48 to 60 cents a pound from year to year. Mr. Beall pronounces the breed healthy, and that in two years he had not found it necessary to nurse one of his lambs. Let our farmers, then, try this breed, and the Leicesters particularly. Mr. Hayes says the Leicester is the most important of the long-wooled English races, particularly for crossing.

If sheep-breeders are breeding to sell to others pure bloods from which to propagate, of course they must breed the highest bred, purest stock, without admixture of other blood; this rule will apply to Virginia as well as to other States. In large tracts of land, particularly in our mountain region, the Merinos, we think, will prove most profitable, as here wool should be the chief consideration. This is the pastoral system, having reference to wool chiefly, very little to mutton, and with no expectation of improving these mountain tracts and making them available for cultivation. The Merino is remarkable for vigorous health and its capacity for herding in large flocks, and also for tenderness and juciness of its meat, and is not to be despised for mutton. For general purposes of wool and mutton, the cross from the native ewes with Spanish or American Merino bucks is to be recommended, the progeny being much improved, and having constitution, hardiness, fattening properties, thriftiness, and a compact, valuable fleece.

On the rich grasses of the Valley of Virginia and Piedmont the Cotswold are generally preferred for the combing wools, mutton, and lambs, some preferring the Southdowns as more profitable for mutton. Those of our farmers who have tried the crosses of Cotswold and Merinos are much pleased with the progeny. Hon. J. E. Massey, Auditor of Public Accounts of Virginia, in an interesting article prepared by him for the Charlottesville *Jeffersonian* on "Sheep-breeding for Virginia," states that he has found a cross of the Cotswold and Merino very desirable, and also a cross of Lincoln and Merino. He sent us samples of wool from these crosses, which exhibit the modification of the Cotswold and Lincoln fleeces by imparting to them fineness and softness of fibre, and density of fleece and strength of staple by the infusion of Merino blood. He also sent samples of the cross of the Lincoln and Cotswold, which showed improvement in the wool by imparting to it some of the lustre of the Lincoln. The crosses of our native ewes with Merino, Cotswold, Southdown, are all desirable, all improving the common

stock—the former in wool, the second in mutton and wool, and the latter in mutton, and the native ewe imparting its hardiness to the cross. Mr. J. Wearmouth, before spoken of, says: “I think it is best to breed from the common or native ewes of the country, crossed with a Southdown buck.”

Col. John Washington, of Caroline, who is engaged quite largely in sheep-breeding, finds raising lambs for the northern markets the most profitable part of sheep husbandry. He says of his lambs: “If dropped during the month of January, they are ready for the New York market in April, and always bring a good price, and are thus cash in about 90 days. The next source of profit is the wool. When the latter is high, and particularly if the combing wool is in demand, the Cotswold is the most profitable breed. If wool is not high, I prefer the cross of Cotswold and Southdown, as good lambs and heavy fleeces are thereby secured. My Cotswold ewes usually clip from 7 to 8½ pounds (free of briars, burrs, &c.,) each. I think lambs at \$4 to \$5 apiece, when 90 days old, more profitable than mutton 18 months old at \$6 to \$8.”

We think if Col. Washington would cross the Leicester with the Cotswold or Southdown he would increase the precocity of his lambs and quality of the wool by imparting to it the lustre of the Leicester, and more fineness in quality, besides hastening the maturity of his mutton.

To sum up in a general manner, which, however, must be taken with some modification for individual localities and peculiar circumstances, we would say for Tidewater Virginia we would select the Cotswold and Merino cross, and when having reference to wool and lambs and mutton, to mix in the Leicester, for its early maturity and lustre of fleece; and if mutton was a primary object, to substitute Southdown or Oxforddown for Cotswold. For Middle Virginia, principally the same breeds, except that in those portions removed from Tidewater and easily accessible markets, more attention should be paid to wool, the freight on which is so small, as compared with mutton or lambs, and which may be sent away at leisure and convenience. For the Piedmont and the Valley, Cotswold and Merino for wool, lambs, and mutton; and for the mountain regions, principally the Merino, or Saxony, or Silesian for wool. In breeding for wool, let our farmers remember that great length of wool is incompatible with density of fleeces, and in breeding for great length of staple they do so at a sacrifice of density, so important to secure and retain, and that this can be best accomplished by the use of the wrinkly Merino rams. Where wool is the main object a great deal can be accomplished at little cost and trouble by breeding the American Merino buck to our native ewes; in this way no more healthy sheep can be obtained, and none that will better bear herding.

In conclusion, I may say that the adaptability of Virginia to sheep-raising is well established and confirmed. In a letter just received from Dr. John R. Woods, of Albemarle, one of the most intelligent farmers and sheep-breeders in the whole country, he says he is convinced that there is no better region anywhere for sheep-breeding than Piedmont Virginia. Hon. John B. Killebrew, in his excellent work, “Sheep Husbandry in Tennessee,” in confronting an opinion of Mr. Henry Stewart (“The Shepherd’s Manual”) that sheep do not thrive on metamorphic soils, says: “This may be true of the latitude of Old England and New England, but in the latitude of Tennessee, North Carolina and Virginia, sheep upon those soils are fruitful, long lived, and abundant bearers of wool.

* * As far as Virginia, North Carolina and Tennessee are concerned, this opin-

ion is not true at all. In my opinion, no better spot could be selected for a sheep farm than the slopes of the Alleghany mountains. They are well drained, they are fertile, they abound in native grasses, they are convenient to market, they supply a safe refuge from the heats of summer and from the chilling blasts of winter, and from the vexatious annoyance of flies. But I would not advise the growing of heavy sheep except on the level plateaus. The hardy Merino, the fleet-footed Cheviot would find on the sunny slopes of these mountains a home far more congenial than upon the Pyrannees of Spain or the Grampian hills of Scotland. The natives found on these mountain heights are as fleet as the deer and as healthy. The wool is very white, soft as fur, firm, lustrous, true, and the sheep show a beautiful adaptation to the locality they occupy. The natives crossed with the Merino or Cheviot would give the very best sheep for the mountains."

Yours truly,

THOS. POLLARD,
Commissioner of Agriculture of Virginia.

We have received the following Census returns of the sheep in each county in the State, as also the fleeces and their weights for each county. Besides the number of sheep we give only the total number of fleeces and their aggregate weight:

SHEEP.

FIRST DISTRICT.	
Accomac.....	5,379
Charles City.....	2,943
Elizabeth City.....	1,137
Essex.....	4,383
Gloucester.....	4,406
Greenville.....	1,689
Isle of Wight.....	3,014
James City.....	1,253
King and Queen.....	4,974
King William.....	3,653
Lancaster.....	1,423
Matthews.....	1,613
Middlesex.....	2,765
Mansemond.....	1,539
New Kent.....	1,335
Norfolk.....	1,200
Northampton.....	2,503
Northumberland.....	3,956
Prince George.....	1,890
Princess Anne.....	6,035
Richmond.....	2,337
Southampton.....	3,869
Surry.....	1,369
Sussex.....	2,260
Warwick.....	592
Westmoreland.....	3,975
York.....	690
Total.....	70,477
SECOND DISTRICT.	
Amelia.....	2,649
Appomattox.....	2,444
Bedford.....	13,344
Brunswick.....	5,933
Buckingham.....	4,230
Campbell.....	4,453
Charlotte.....	5,148
Chesterfield.....	5,957
Cumberland.....	2,517
Dinwiddie.....	3,431
Franklin.....	11,685
Halifax.....	5,319
Henry.....	3,596
Lunenburg.....	6,012
Mecklenburg.....	8,437
Nottoway.....	2,763
Patrick.....	7,273
Pittsylvania.....	7,297
Powhatan.....	4,369
Prince Edward.....	2,259
Total.....	109,616
THIRD DISTRICT.	
Albemarle.....	19,431
Amherst.....	4,492
Caroline.....	4,907
Culpeper.....	31,969
Fauquier.....	42,413
Fluvanna.....	3,771
Goochland.....	2,373
Greene.....	2,630
Hanover.....	4,522
Henrico.....	1,044
King George.....	3,753

SHEEP.—CONTINUED.

THIRD DISTRICT.—CONTINUED.	
Louisa.....	6,967
Madison.....	7,299
Nelson.....	4,881
Orange.....	11,739
Prince William.....	16,926
Rappahannock.....	18,905
Spotsylvania.....	5,361
Stafford.....	4,667
Total.....	192,630
FOURTH DISTRICT.	
Alexandria.....	86
Augusta.....	90,707
Bath.....	4,959
Clarke.....	26,779
Fairfax.....	7,071
Frederick.....	24,073
Highland.....	13,790
Loudoun.....	63,178
Page.....	6,863
Rockbridge.....	10,110
Rockingham.....	14,106
Shenandoah.....	12,200
Warren.....	10,785
Total.....	214,610
FIFTH DISTRICT.	
Alleghany.....	2,640
Bland.....	9,639
Botetourt.....	4,636
Buchanan.....	8,564
Carroll.....	14,436
Craig.....	4,561
Floyd.....	12,547
Giles.....	7,996
Grayson.....	19,614
Lee.....	14,996
Montgomery.....	8,613
Pulaski.....	10,213
Roanoke.....	3,068
Russell.....	17,305
Scott.....	20,053
Smyth.....	14,304
Tazewell.....	19,032
Washington.....	19,377
Wise.....	10,531
Wythe.....	14,359
Total.....	236,453
Grand total.....	826,776
Number of fleeces (in the State).....	496,300
Weight, pounds.....	1,883,586

This is nearly four pounds to the fleece—quite a good average for all kinds of sheep raised in the State.

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